BANGALORE METRO RAIL CORPORATION LIMITED

BANGALORE METRO RAIL PROJECT PHASE-I & II

Supply, Installation, Testing and Commissioning of Commercial Power Point Metering Panels and arranging Power Supply from Metering Panels up to promotional KIOSKS in all Stations of Bangalore Metro Rail Project Phase-1 & Phase-2

Tender File No. BMRCL/PD/CPP&MP/PH-1&2/2022-23/DPO/388

Summary of Tender Documents

Volume – 1 : Qualification cum Technical Package

- Section I - Notice Inviting Tender (NIT)

Part - A

- Section II - Instructions to Tenderers (ITT)
- Section III - General Conditions of Contract (GCC)
- Section IV - Special Conditions of Contract (SCC)
- Section V - Form of Tender
- Section VI - Proforma
    - Annexure A – Form of Agreement
    - Annexure B – Form of Bank Guarantee for Tender Security/EMD
    - Annexure C – Form of Bank Guarantee for Performance Security
    - Annexure D – Proforma Indemnity Bond
    - Annexure E – Tenderer's Declaration
    - Annexure F – Undertaking by The Tenderer
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- Technical Specifications

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VOLUME – 1

SECTION - I

NOTICE INVITING TENDER (NIT)

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BANGALORE METRO RAIL CORPORATION LIMITED
III Floor, BMTC Complex, K.H. Road,
Shanthinagar, Bangalore – 560 027
Karnataka, India
E-mail: contactus@bmrc.co.in; **Web:** www.bmrc.co.in;

No: BMRCL/2023-24/EL/WORK_INDENT1 Date: 28.07.2023

TENDER NOTIFICATION

Bangalore Metro Rail Corporation Ltd., (BMRCL) a Joint Venture of Government of Karnataka (GoK) and Government of India (GoI), invites Tenders **(Single stage-Two Envelope System)** through Karnataka Public Procurement Portal (e-Procurement Portal) from the Tenderers having valid **"Electrical Class -1 License"** issued by the **Electrical Inspectorate, Government of Karnataka,** and having previous experience in the Works of HT/LT Electrical Installations, volume and complexity completed during the last Five (5) Years as mentioned in the Tender documents for the work mentioned below.

The brief scope of the work is provided in Instructions to the Tenderers (ITT) and the detailed description of work is provided in Technical Specifications.

Key details:

Tender Notification No: BMRCL/2023-24/EL/WORK_INDENT1.		
Name of the Work: *Supply, Installation, Testing and Commissioning of Commercial Power Point Metering Panels and arranging Power Supply from Metering Panels up to promotional KIOSKS in all Stations of Bangalore Metro Rail Project Phase-1 & Phase-2*.		
Sl.No	**Description**	
1.	Estimated cost of Work	**Rs. 5,68,86,555.00** (Rupees Five Crore Sixty Eight Lakh Eighty Six Thousand Five Hundred and Fifty Five Only)
2.	Tender Security / EMD (In Rs)	**Rs.8,53,298/-** The EMD (Tender Security) shall be furnished in the form of a Bank Guarantee (B.G) in favour of Bangalore Metro Rail Corporation Limited.
3.	Completion period of Works	9 Months including monsoon period
4.	Receipt of tender last date	Tender documents to be downloaded from Karnataka Public Procurement Portal (https://kppp.karnataka.gov.in) As per Date and Time specified in e-Procurement Portal.
5.	Last date for seeking Clarification	As per Date and Time specified in e-Procurement Portal.
6.	Last Date and Time for Receipt of Bid / Tender	As per Date and Time specified in e-Procurement Portal.
7.	Pre Bid Meeting	As per Date and Time specified in e-Procurement Portal.
8.	Date and Time of Opening of Technical Bid/Tender Opening (Qualification Cum Technical Package)	As per Date and Time specified in e-Procurement Portal

Sl.No	Description	
9.	Date and Time of Opening of Financial Bid/Tender (Financial Package)	Will be intimated to the Qualified Tenderers through e-Procurement Portal. Tenderers to trace the same.
10.	Place of Opening of Tender (Qualification Cum Technical Package & Financial Package)	The opening of the Qualification cum Technical Package shall take place at e-Procurement portal, i.e. https://kppp.karnataka.gov.in
11.	Address for Communication	**The Chief Engineer(U/S),** Bangalore Metro Rail Corporation Limited., III Floor, BMTC Complex, KH Road, Shanthinagar, Bangalore- 560027, Karnataka, India. Tele: +91 80 22969233, FAX +91 80 2296 9222, E-mail: bnataraja@bmrc.co.in

Chief Engineer (U/S)
Bangalore Metro Rail Corporation Ltd

BANGALORE METRO RAIL CORPORATION LIMITED
III Floor, BMTC Complex, K.H. Road,
Shanthinagar, Bangalore – 560 027
Karnataka, India
E-mail: contactus@bmrc.co.in; **Web:** www.bmrc.co.in;

Tender No. BMRCL/2023-24/EL/WORK_INDENT1 **Date: 28.07.2023**

NOTICE INVITING TENDER

1. Bangalore Metro Rail Corporation Ltd., (BMRCL) invites Tenders from the eligible Contractors having valid **"Electrical Class-I License"** issued by the **Electrical Inspectorate, Government of Karnataka,** for the work of **"**Supply, Installation, Testing and Commissioning of Commercial Power Point Metering Panels and arranging Power Supply from Metering Panels up to promotional KIOSKS in all Stations of Bangalore Metro Rail Project Phase-1 & Phase-2**".** Local competitive Bidding (LCB) will be conducted in accordance with the "Single Stage-Two Envelope" Tendering Procedure through Karnataka Public Procurement Portal (e-Procurement Portal). This Tender is a 'PERCENTAGE TENDER'.
2. Details of the Tender are as under:

Sl. No	Name of the Work	Estimated Cost of work (INR)	Tender Security / EMD (INR)	Period of completion of work
1.	Supply, Installation, Testing and Commissioning of Commercial Power Point Metering Panels and arranging Power Supply from Metering Panels up to promotional KIOSKS in all Stations of Bangalore Metro Rail Project Phase-1 & Phase-2.	5,68,86,555/-	8,53,298/-	9 Months

3. **REGISTRATION:**

a) Tenderers are required to enroll on the e-Procurement Portal (https://kppp.karnataka.gov.in) by clicking on the link "Tenderers Registration" on the Karnataka Public Procurement Portal by paying requisite registration fee

b) As part of the enrolment process, the Tenderers will be required to choose a unique user name to assign a password for their accounts.

c) Tenderers are advised to register their valid email addresses and mobile numbers as part of the registration process. These would be used for any communication with the Tenderer.

d) Upon enrolment, the Tenderers will be required to register their valid Digital Signature Certificate (Only Class III Certificates with signing + encryption key usage) issued by any Certifying Authority recognized by CCA India.

e) Only one valid DSC should be registered by a Tenderer. Please note that the Tenderers are responsible to ensure that they do not lend their DSCs to others which may lead to misuse.

f) Tenderers then login to the website through the secured log-in by entering their user ID/password and the password of the DSC / e-Token.

g) The scanned copies of all original documents (as required) should be uploaded on portal in PDF/JPG format.

h) For any query regarding e-procurement on the Karnataka Public Procurement Portal, contact helpdesk number: +91-8046010000, +91-8068948777, support@eprochelpdesk.com.

4. **SEARCHING FOR TENDERS/BIDS:**

Once the Tenderers have selected the proposal bids/tenders and if they are interested to participate, the Tenderers can pay non-refundable processing fee to Karnataka Public Procurement Portal.

However, the tenderer shall submit such transaction details along with their tender submission on e-portal. If the same transaction reference number has been submitted for more than one bid, all such bids shall be considered ineligible and summarily rejected.

It will be the responsibility of the Tenderer to check the website and see any Addendum/Corrigendum issued in this tender from time to time and ensure submission of Tender submittals binding accordingly.

5. Tender documents consist of the following Volumes/Parts/Sections,

Volume – 1: Qualification Cum Technical Package

- SECTION – I Notice Inviting Tender.

Part - A

- SECTION – II Instructions to Tenderers.
- SECTION – III General Conditions of Contract
- SECTION – IV Special Conditions of Contract
- SECTION – V Form of Tender
- SECTION – VI Proforma

Part – B

- Technical Specifications

Volume – 2: Financial Package

6. Tenderer's submittals must be accompanied by a EMD/Tender Security for an amount as mentioned at in the table under Tender Notification clause 2, in the requisite form as described in clause 16 of Instructions to Tenderers (ITT). The EMD shall be valid for a period of 45 days beyond the validity of Tender.
7. Tenders must be submitted electronically through Karnataka Public e-Procurement Portal (https://kppp.karnataka.gov.in) before the last date & time prescribed in the e-procurement portal using a valid DSC (Digitally signed certificate).

All Tenderers are requested to note that the original of those documents in hardcopy as listed under ITT clause 13.2 should be submitted by 'Speed post' or 'in person' at BMRCL office within **5 days** from last date of Tender submission. Tender submission without such submission of original documents shall be liable for rejection.

8. 'Qualification cum Technical Package' will be opened as per the latest specified time and date published in the e-Procurement portal.

The Financial Packages of technically qualified Tenderers will be opened at a date and time advised by BMRCL through e-Procurement portal.

9. The Tenderer shall provide credentials in support of their eligibility, qualifying criteria, technical capability, financial strength/support and past work experience by supporting documents / client certificates / CA's audit reports set forth in ITT Clause 2.

10. Tenders shall be valid for a period of **120 days** from the last date for submission of Tenders.
11. Tenders cannot be submitted online after stipulated time of submission of Tender.
12. The Contract shall be governed by the stipulations of documents listed under 'Contract Agreement' as per Annexure-A Section-VI - Proforma.
13. BMRCL requires that Tenderers and Contractors observe highest standard of ethics during the procurement and execution of Contract. In pursuance of this policy, the Employer;
    a) Will reject the Tender for the Work or rescind the Contract, if BMRCL determines that the Tenderer / Contractor have engaged in Corrupt or Fraudulent practices, at any stage.
    b) will declare a Contractor ineligible, either indefinitely or for a stated period of time, to be awarded a Contract, if he at any time determines that the Tenderer or the Contractor has engaged in Corrupt or Fraudulent practices in competing for, or in executing, the contract.
14. BMRCL reserves the right to accept or reject any or all Tenders in part or full without assigning any reasons. No Tenderer shall have any cause of action or claim against BMRCL for rejection of his Tender.
15. Registered Tenderers with e-token are advised to frequently check the e-Procurement portal for any amendments like Addendum / Corrigendum.
16. BMRCL will not be held responsible for consequential damages/losses due to lack /interruption of power supply & internet, low speed of internet, System problems, loss of electronic information/data etc.
17. For further clarifications/details regarding the Tender document, contact: The Chief Engineer (Utility Shifting), BMRCL on +91 80 2296 9233, Fax +91 80 2296 9222, Email: bnataraja@bmrc.co.in.

    For any query regarding eProcurement portal/ Tender submission, please contact helpdesk at +91-80-46010000, +91-80-68948777, Email: support@eprochelpdesk.com.

Chief Engineer (U/S)
Bangalore Metro Rail Corporation Ltd

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PART - A

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Section III	-	General Conditions of Contract (GCC)
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SECTION – II

INSTRUCTIONS TO TENDERERS (ITT)

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SECTION- II: INSTRUCTIONS TO TENDERERS

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SECTION II – INSTRUCTIONS TO TENDERERS (ITT)

A. GENERAL

1. Brief Description of the Project:

1.1 Bangalore Metro Rail Corporation limited (BMRCL), a Special Purpose Vehicle (SPV) established under the Companies Act, 1956 (hereinafter referred to as "BMRCL" or "the Company" or "the Employer" or "the Client") invites Tenders from the registered Electrical Contractors ("Class – I Electrical License" issued by the Electrical Inspectorate, Govt. of Karnataka) under single stage two packet system for "Supply, Installation, Testing and Commissioning of Commercial Power Point Metering Panels and arranging Power Supply from Metering Panels up to promotional KIOSKS in all Stations of Bangalore Metro Rail Project Phase-1 & Phase-2" as per terms and conditions contained in this Tender documents.

Bangalore Metro Rail Corporation Ltd. (BMRCL) is implementing the Bangalore Metro Rail Project in different phases. The Phase – I of the project comprises of two Corridors Viz. East-West Corridor (Purple line) and North– South Corridor (Green line) consisting of Elevated, at Grade and Underground sections as below:

Sl. No	Corridor/Section	Number of Stations	Approx. Length (Km)
1	East–West corridor (Purple line) from Baiyappanahalli Station to Mysore Road Station.	17	18.10
2	North- South corridor (Green line) from Nagasandra Station to Yelachenahalli Station.	23	24.20
Total		**40**	**42.30**

1.2 BMRCL is proceeding with the implementation of Phase-2 of the project. The sanctioned Detailed Project Report (DPR) of Phase-2 envisages extension of existing two corridors viz. East-West (Purple line) and North-South (Green Line) Corridors comprising of elevated sections and construction of two new lines Reach-5 and Reach-6.

The details of Extension lines and New lines under Phase-2 are given below:

Sl. No	Corridor/Section	Number of Stations	Length (Km)
1	**East Extension (R1A & R1B):** Baiyappanahalli to ITPL Whitefield (Elevated) with Depot at Whitefield	13@	15.42
2	**West Extension (R2A & R2B):** Mysore Road to Challaghatta (Elevated) with Depot at Challaghatta	7	8.85
3	**North Extension (R3C):** Nagasandra to Bangalore International Exhibition Centre (BIEC) (Elevated) with Depot at Peenya	3	2.95
4	**South Extension (R4B):** Yelachenahalli to Silk Institute (Elevated) with Depot at Anjanapura	5	6.55

Sl. No	Corridor/Section	Number of Stations	Length (Km)
5	**Reach-5** : R V Road to Bommasandra Industrial Area (New Line - Elevated) with Depot at Hebbagodi	16$	18.82
6	**Reach-6 (Elevated)**: Kalena Agrahara to Swagath Road Cross (New Line) with Depot at Kothanur	6$	8.18
	R6 (Underground): Swagath Road Cross to Nagavara (New Line) with Depot at Kothanur	12#	14.27
Total		**62**	**75.04**

@ - includes two-level common interchange station at K.R. Puram with ORR Metro line.

$ - includes two-level common interchange (between Reach-5 & Reach-6) station at Jayadeva Hospital. Also, Stations at Rashtreeya Vidyalaya (R.V) Road & Central Silk Board shall have interchange with other lines of BMRCL.

 # - includes two-level common interchange stations at M.G. Road and Nagavara with other lines of BMRCL.

South Extension is commissioned in January 2021, West Extension in August 2021, East extension in March-2023 and other Reach is under advanced stage of completion.

1.3 Two more new lines under Phase-2A and Phase-2B are being constructed. Details of New lines under Phase-2A and 2B are given below:

Sl. No.	Corridor/Section	Number of Stations	Length (Km)
1	**Phase- 2A**: Silk board to K R Puram with Depot at Baiyappanahalli Phase 2A (8+8 stabling lines at grade and -1 level)	14 Number of Stations (All Elevated Stations)	19.75
2	**Phase-2B**: K R Puram to Airport Terminal with two Depots at Baiyappanahalli Phase 2B (14+14 stabling lines at grade and -1 level) and Trumpet	18 Number of Stations (16 Elevated Stations, 1 UG Station & 1 at grade Station)	38.44
Total		31 Number of Stations	**58.19**

***Interchange Stations** of different lines: -*

- *The common interchange station between Reach-6 line and Phase-2B line is at **Nagavara** station.*
- *The common interchange station between Phase-2A and Reach-5 is at **Central Silk Board** station.*
- *The common interchange station between Phase-2A and Line-1 is at **KR Puram** Station.*

Maintenance Depots are located at Baiyappanahalli for Phase-2A & 2B and Airport (Trumpet) Depot for Phase-2B. An Integrated Operation Control Centre (OCC) is being constructed at Baiyappanahalli for Reach-5, Reach-6, Phase-2A (ORR) & Phase-2B (Airport line) and a Back-up Control Centre (BCC) is located at Peenya.

1.4 **Brief scope of work**

The work shall include, but not limited to Supply Installation, Testing and commissioning of LT Panels, cables & other electrical equipments etc….

i. Erection of LT Metering panels as per specifications at various locations.
ii. Installation testing & commissioning of LT commercial metering panels during non-revenue period of Metro Rail operations (Only after 23.00 Hrs up to 4.00 Hrs at Night).
iii. Taking approval from BESCOM for arranging Sub Meter at each stations of BMRCL.
iv. The New system (work) is to be tested, commissioned and handed over to BMRCL under acknowledgement.

The details of equipment to be supplied, transported, erected, assembled, tested & commissioned are indicated in BOQ / Pricing Document schedule of Works. The quantities indicated in the BOQ / Pricing Document Schedule of works are only approximate and may increase or decrease and prices quoted by the Tenderer are deemed to be valid in spite of such variations subject to SCC Clause 10.

Any other items not specifically mentioned but which are essentially required for satisfactory performance & completeness of work, shall be deemed to be included in the scope of specifications and works and the same shall be executed / carried out by the Tenderer at no extra cost to BMRCL.

2. Technical/ Financial Eligibility Criteria for Tenderers:

2.1 The Tenderer shall have proven track record and must satisfy the criteria stated below for further evaluation and selection.

2.2 The Tenderer should have a valid **"Class – I Electrical License"** issued by the Electrical Inspectorate, Government of Karnataka. Attested copy of the License shall be furnished. Original Document of the license shall be produced for verification by BMRCL after opening of the Qualification cum Technical Package as requested.

2.3 **Technical Eligibility Criteria:**

The Tenderer should have an experience of carrying out similar electrical works such as: Working in construction of distribution networks of LT/HT (11kV) underground and overhead lines, Layout electrification and Commissioning and should have completed similar works during the last five years ending 28 days prior to date of opening of Tender and fulfill the following to establish the same:

i. The Tenderer should have completely executed at least **One similar work** valued not less than **Rs. 2,84,43,277/- (Rupees Two Crore Eighty-Four Lakhs Forty Three Thousand Two Hundred and Seventy Seven Only)**

OR

ii. The Tenderer should have completely executed at least **Two similar works** each of value not less than **Rs. 2,27,54,622/- (Rupees Two Crore Twenty-Seven Lakhs Fifty-Four Thousand Six Hundred and Twenty Two Only).**

OR

iii. The Tenderer should have completely executed at least **Three similar works** each of value not less than **Rs. 1,70,65,966/- (Rupees One Crore Seventy Lakhs Sixty-Five Thousand Nine Hundred and Sixty Six Only).**

Note: *The Tenderer shall furnish client's certificates in support of the same. The work completion Certificate issued by client shall mention the nature of work, items and quantity of work executed and the date of completion of work as mentioned above.*

2.4 **Financial Eligibility Criteria:**

Annual Turnover: Each Tenderer in his name should have achieved in at least two (2) out of the last five (5) financial years period (2017-18, 2018-19, 2019-20, 2020-21 and 2021-22) an annual turnover of **Rs 11,37,73,110/-** (Rupees Eleven Crore Thirty Seven Lakhs Seventy Three Thousand One Hundred and Ten Only).

2.5 **Tender Capacity:**

Eligible Tenderers will get qualified only if their available Tender capacity is more than the Tender value. The Tenderer's Tender capacity will be calculated as under:

Tender Capacity = (A X N X 1.5) – B

Where,

A *= Maximum value of Works executed in any one year during the last five years (updated to 2022-23 Price level) taking in to account the completed as well as works in progress.*

N *= No. of years prescribed for completion of the works for which Tenders are invited.*

B *= Value, at 2022-23 price level, of existing commitments and ongoing works to be completed during the next 9 Months, the planned contract period.*

2.6 The Tenderer should not have been black listed by KPTCL / BESCOM / BBMP /KPWD /CPWD / Railways /MES / National High way or erstwhile KEB or by any department of Government of Karnataka and any other Central Government department including PSUs. An undertaking to that effect shall be furnished as per Annexure F in Section VI Proforma.

2.7 **Joint Venture or Consortium is not permitted in this Tender.**

2.8 **DETAILS OF KEY PERSONNEL**

i) For Fresh Tenderers.

The details of deployment of the following personnel should be furnished in Format I.

Format I:

Sl. No	Details of Personnel to be deployed for the tendered works.	Name of the Person	Educational Qualification	Experience	Remarks
1.	Project Manager		BE (Elec.) / Equivalent	10 Years	
	Project Engineer		BE / Diploma (Elec.)	6 Years	
	Site Engineer/s		Diploma (Elec.)	3 Years	

i) **For BMRCL Working Contractors (Those who are already working in BMRCL as Contractors):**

Contractors those who are already awarded Work by BMRCL and intend to participate in the Tender, shall possess the following additional requirements for qualifying in the Tender.

a) Separate team of personnel is required to be deployed for each works, particularly the Project Engineers and the Site Engineers. The curriculum Vitae of the personnel deployed/to be deployed shall be furnished as detailed in Clause (b) below.

b) The details of deployment of the following personnel should be furnished in Format II.

Format II:

Sl. No	Details of Personnel working for the tendered works.	Name of the Person	Educational Qualification	Experience	Remarks
1.	**Personnel for the ongoing work/s:**				
	Project Manager		BE (Elec.)/Equivalent	10 Years	
	Project Engineer		BE / Diploma (Elec.)	6 Years	
	Site Engineer/s		Diploma (Elec.)	3 Years	
2.	**Personnel for the new tendered work:**				
	Project Manager		BE (Elec.)/Equivalent	10 Years	
	Project Engineer		BE / Diploma (Elec.)	6 Years	
	Site Engineer/s		Diploma (Elec.)	3 Years	

2.9 Notwithstanding anything stated above or elsewhere in the Tender specification, BMRCL reserves the right to relax the qualifying requirements and assess the capability/suitability of the Tenderer to perform the overall Contract should the circumstances warrant such assessment in the overall interest of BMRCL.

2.10 The Tenderer shall furnish certified copies of financial reports such as profit and loss statements, balance sheets, auditor's reports, in support of the same, for the financial years 2017-18, 2018-19, 2019-20, 2020-21 and 2021-22. (Provisional financial statements are not acceptable).

2.11 The Tenderer shall furnish documentary evidence in support of the qualifying requirements stipulated above.

3 Cost of Tendering.

The Tenderer shall bear all expenses associated with the preparation and submission of his Tender and the cost of Tender documents/drawings. BMRCL shall in no case be responsible or liable for reimbursement of such expenses or other claims regardless of the conduct or outcome of the Tendering process.

4 Site Visits

4.1 The Tenderer is advised to visit and examine the Site of Works (Kiosks) and familiarize themselves with the nature of work, site conditions, its surroundings and obtain on his own responsibility all information including constraints that may be necessary for preparing the Tender and entering into Contract and carrying out the work. The costs of any such visits shall be entirely at the Tenderers own expense.

4.2 The Tenderer or any of his authorized personnel will be granted permission by BMRCL to enter their premises for the purpose of such inspection, but only on the express condition that the Tenderer and/or his authorized agents, will release and indemnify BMRCL, from and against all liabilities in respect thereof and will be responsible for personal injury (whether fatal or otherwise), loss of or damage to property and any other loss, damage, cost and expenses, however, caused which but for the exercise of such permission would have not arisen.

4.3 The Tenderer shall be deemed to have inspected and examined the site and collected all necessary information regarding all factors and conditions likely to influence in carrying out the work, before uploading on e-procurement portal and submitting his Tender.

5 Brand Names

5.1 Specific reference in the specification to any material by trade name or catalogue number shall be construed as establishing a standard of quality and performance. However, during construction, Tenderers may offer equivalent brand for approval of Engineer-in-charge. It is assumed that the rates quoted cover the cost of specified brands.

5.2 All materials used shall conform to technical specifications, relevant standards and BMRCL / BESCOM / BMRCL approved makes.

6 Stamp Duty and Legal Charges

It shall be the responsibility of the successful Tenderer to pay stamp duty for Contract Agreement or any other matter in connection with the Contract, as per the applicable Government regulations.

7 Time for Completion of Work

Time for completion of the work shall be as stated in Appendix for Form of Tender (Section V).

8 Work Plan

8.1 Within 15 days of award of contract, the successful Tenderer shall submit on the portal a detailed work plan along with manpower deployment in line with ITT 2.8 for the implementation of work complying with the schedule of work as stipulated in the Tender document for supply, installation, testing and commissioning.

8.2 The Tenderer to furnish along with Tender submittals, a list of construction plant, equipment's, list of jobs on hand, name of the Project Engineer for this work to facilitate Tender evaluation.

8.3 The work shall be executed as per BESCOM / BMRCL requirements.

B. TENDER DOCUMENTS

9 Content of Tender Documents

9.1 The Tender consists of the following documents, together with addendum/corrigendum, if any.

Volume – 1: Qualification Cum Technical Package

SECTION – I Notice Inviting Tender.

Part - A

SECTION – II Instructions to Tenderers.
SECTION – III General Conditions of Contract
SECTION – IV Special Conditions of Contract
SECTION – V Form of Tender
SECTION – VI Proforma

Part – B

Technical Specifications

Volume – 2: Financial Package

10 Interpretation and Clarification of Tender Documents

11.1 Tenderers shall carefully examine the Tender Documents and fully understand the conditions and matters which may affect the work or the cost thereof. In case the Tenderer finds any discrepancies or omission from the specification or other documents, or in doubt as to their meaning, the Tenderer shall at once address query (ies) online through Karnataka Public Procurement Portal (e-Procurement portal).

BMRCL will offer clarification to such queries received through eProcurement portal up to the date specified therein. Any such queries with details of clarification sought, will be uploaded in the eProcurement portal (https://kppp.karnataka.gov.in) without disclosing the identity of the Tenderer seeking clarification. No separate further communication in this regard will be entertained.

11 Amendment of Tender Documents

11.1 At any time prior to the deadline for the submission of Tenders, BMRCL may, for any reason, whether at their own initiative or in response to clarifications requested by prospective Tenderers modify, the Tender document by issuing Addenda / Corrigendum.

11.2 Such Addenda / Corrigenda will be uploaded in the e-Procurement portal. It will be the responsibility of the Tenderer to frequently check the portal for any Addenda/Corrigenda or any other updates issued from time to time and ensure submission of Tender accordingly.

11.3 The Tenderer is not permitted to make any alterations/modifications to the Tender conditions. No modifications to the specifications, item descriptions, etc. will be entertained.

C. PREPARATION OF TENDERS

12 Language of the Tender

12.1 Tenders and all accompanying documents shall be in English. In case any accompanying printed literature is in other language, it shall be accompanied by an English translation. The English version shall prevail in matters of interpretation.

13 Documents Comprising the Tender

13.1 The Tender submittals shall comprise the following documents and Tenderer shall upload clear and readable scanned copies of these documents on e-Procurement Portal.

i. Qualification cum Technical Package~~:~~

a) Tender Security / EMD, in accordance with ITT clause 16. In case of non-legible EMD document, tender will be summarily rejected.

b) A Covering Letter stating any other matter in relation to his Tender which the Tenderer considers should be drawn to the particular notice of BMRCL.

c) Valid “Class-I Electrical License” issued by the Electrical Inspectorate, Government of Karnataka.

d) Tenderer’s Declaration as per Annexure-E, Section-VI.

e) Tenderer’s Undertaking as per Annexure-F, Section-VI.

f) Work Experience details as per Annexure-G, Section-VI

g) Work completion certificate(s) to establish the Eligibility Criteria.

h) Financial eligibility information as per Annexure-H, Section-VI.

i) Contractor's Equipment/Machinery Details as per Annexure-I, Section-VI.

j) List of manpower including the Bio-Data of Engineer-in-charge.

k) Notarized Power of Attorney of the person who is signing the Tender submittals.

l) Tender Index indicating all the Tender submittals with identical page numbers.

m) Any other document required under the provisions of Tender document.

ii. Financial Package

The Tenderer shall fill in and complete the 'Financial Package' online through Karnataka Public Procurement Portal only and no hardcopy of commercials should be attached or disclosed elsewhere.

13.2 **Original Documents (Hardcopy):**

The Tenderer is required to submit the following documents in original (hard copy) within the date time and place mentioned in ITT Clause 20.7:

(i) Tender Security / Earnest Money Deposit (EMD), as per ITT clause 16,

(ii) Notarized Power of Attorney and Board Resolution (as applicable) as per ITT clause 18.

(iii) Any other documents as specified in the tender document.

In case of failure in submission of the above documents within stipulated date, the Tender may be treated as incomplete and be liable for rejection.

14 Tender Prices

14.1 The Tender is **Percentage Tender**. The Contract shall be for the whole of the works as described in the tender documents and the cost of all the individual items shall be computed for the entire work and the Tender premium (above or below or at par) on the Total cost shall be quoted.

14.2 Contract prices shall be inclusive of all applicable taxes, duties and cess including taxes to be deducted at source, Insurance and exclusive of SGST and CGST as specified under GCC clause 26. BMRCL shall pay the SGST and CGST as applicable as per laws. The evaluation and comparison of Tenders shall be made accordingly by BMRCL. No claim will be entertained on this account after acceptance of the Tender or during the currency of the Contract.

14.3 Any additional item/s which is not found in the BOQ, if required for completion of the work under this Contract, the rate for which shall be as per referred BESCOM / KPWD Schedule of Rates plus accepted Tender premium. If the item/s required is not found in any of the State Schedule of Rates, then market rate shall be adopted, but no Tender premium would be applicable.

14.4 If the Tender submittal contains any handwritten portion, it shall be ensured that such writing is clear, legible and duly authorized by the person signing the Tender and that no over writing or erasing is adopted, failing which the Tender is liable for rejection.

14.5 The Tenderer shall keep the contents of his tender and percentage quoted by him confidential.

15 Currencies of Tender and Payment

15.1 The price shall be quoted in Indian Rupees only. All payments to the Tenderer, under the proposed Contract shall be in Indian Rupees.

16 Tender Security / Earnest Money Deposit (EMD)

16.1 The Tenderer shall furnish, as part of its Tender, interest free Tender Security / EMD as per Karnataka Public Procurement Portal.

16.2 The Tender Security / EMD is required to protect BMRCL against the risk of Tenderer's conduct which would warrant the security's forfeiture.

16.3 The Tender shall furnish with his tender, an EMD (Tender Security) for the value indicated in e-Procurement Portal in any of following mode:

a) The tenderer shall pay full EMD (Tender Security) amount through e-procurement portal by making online payment through the e-Procurement Portal.

OR

b) The tenderer shall pay full EMD (Tender Security) as mentioned on the portal shall be furnished in the form of a Bank Guarantee (B.G) issued in favour of Bangalore Metro Rail Corporation Ltd., from Indian Schedule Bank (excluding Co-operative banks) or from a Scheduled Foreign Bank as defined in section 2(e) of RBI Act 1934 read with Second preferably drawn on and payable and extendable at a designated Branch in Bangalore, as per the proforma given in Annexure-B, Section-VI.

The Tender Security/EMD shall remain valid for a period specified in 'Appendix to Form of Tender'. The validity of Tender Security/ EMD shall be extended by the Tenderer suitably in line with the extension of Tender validity as per ITT clause 17.

The Scheduled Bank issuing the Bank Guarantee should preferably be on "Structure Financial Messaging System (SFMS)" platform. A separate advice of the BG shall preferably be sent by the issuing bank to the Employer's Bank through SFMS.

The issuing Bank shall send the SFMS to:

Name: BANGALORE METRO RAIL CORPORATION LTD.,
Name of the Bank: BANK OF INDIA
Branch: CANTONMENT BRANCH, BENGALURU.
Account No: 840420110000760
RTGS/IFSC: BKID0008404

The scanned copy of the BG and a copy of "MT760COV (for Bank Guarantee message) / MT767COV (for Bank Guarantee amendment message) Report" sent by the BG issuing Bank, should be uploaded by the tenderer in the e-Procurement Portal as a part of his offer during tender submission. The tenderers should ensure that both the documents (scanned copy of BG and copy of SFMS message) are uploaded to the e-procurement portal, failure of which, the tender will be summarily rejected by the Employer. The Original Bank Guarantee shall compulsorily be submitted in the BMRCL office before scheduled date, time and place

as specified under ITT clause 20.7. The tenderer shall note that the Original Bank Guarantee submitted through speed post/ in person, if not received before the scheduled date and time as specified in ITT clause 20, the Tender will be summarily rejected.

The details of the Bank Guarantee, Physically submitted should match with the details available of the scanned copy uploaded and the data entered during Tender submission time, failing which, the Tender will be rejected.

In case of non-reconciliation of online EMD (Tender Security) portion through e-Procurement portal in Government of Karnataka central pooling account held at the ICICI Bank, the tender will get rejected.

16.4 Tender Security/EMD will not be accepted in any form other than those mentioned above. Tenders not accompanied by the required amount of Tender Security/EMD and non-submission of hardcopy as per ITT clause 20.7 will be rejected by the Employer.

However, BMRCL reserves the right to accept or reject the Tender Security/EMD with any deficiency otherwise not materially affecting the technical qualification criteria of the Tenderer.

16.5 The Tender Security/EMD of unsuccessful Tenderers will be released / returned, when the Contract Agreement has been signed with the successful Tenderer. However, the Tender security of the successful Tenderer will be released/returned on receipt of the Performance Security / Security Deposit by the Employer and upon signing of the Contract Agreement as per Annexure-A, Section VI.

16.6 The Tender Security/EMD may be forfeited:

a. If a Tenderer withdraws his Tender during the period of Tender validity,

OR

b. If a Tenderer resiles abandon from a Tender,

OR

c. In case the successful Tenderer fails to:
   (i) furnish the required Performance Security / Security Deposit as per ITT clause 32, and
   (ii) sign the Contract Agreement as per ITT clause 33 and GCC clause 12.

16.7 The tender will be summarily rejected by the Employer in case of:

(i) Failure to deposit online EMD portion and failure to upload clear & readable copy of Bank Guarantee towards Balance EMD.

(ii) Failure to submit the Original Bank Guarantee to BMRCL Office within the date & time specified.

(iii) EMD (Tender Security) in the form of Bank Guarantee is from any source other than an Indian Scheduled Bank and Scheduled Foreign Bank as defined in Section 2 (e) of RBI Act 1934 read with Second Schedule.

(iv) The EMD (Tender Security) in the form of Bank guarantee is from a Co-operative bank.

(v) The EMD (Tender Security) amount is less than the required amount as mentioned in NIT.

(vi) The Bank Guarantee's validity is less than Tender validity as mentioned in clause 17 of Instructions to tenderers (ITT).

In case EMD (Tender Security) is in the form of BG, and BG validity fulfils the 'Tender Validity Period', but falling short in regard to period of 'EMD (Tender Security) Validity' , the Employer shall request such Tenderer(s) in writing to submit compliant EMD (Tender Security) within 10 (Ten) working days from the date of request. Failure to provide a compliant EMD (Tender Security) within the prescribed period shall cause the rejection of the Tender and it will be considered as Non-responsive.

17 Tender Validity

17.1 Tenders shall be valid for acceptance for such period as stated in 'Appendix to Form of Tender' (Section-V). Tenders valid for a period shorter than specified period of validity as aforesaid shall be rejected.

17.2 In exceptional circumstances, prior to expiry of the original Tender validity period, the Employer may request the Tenderers to extend the validity for a specified additional period. The request and the responses thereto shall be made in writing only or by facsimile or E-mail. A Tenderer may refuse the request without forfeiting the Tender Security/EMD. A Tenderer agreeing to the request will not be required or permitted to modify his Tender. Only one communication either extending the validity or refusing to extend the validity would be entertained. If the validity is not extended, no further representation, if any, to revive the Tender at a later date will be entertained.

18 Format and signing of Tenders

18.1 The Tenderer shall follow and submit the Tender documents in the respective formats prescribed under section -VI- proforma only.

18.2 The Tender submittals shall be typed or written in indelible ink (wherever required), which is to be scanned and digitally signed using class-III digital signature by person(s) duly authorized to bind the Tenderer to the Contract. Proof of authorization shall accompany the Tender in the form of notarized 'Power of Attorney'. All pages of the Tender where entries, amendments, corrections, alterations, erasures etc. have been made shall be initialized by the person(s) signing the Tender.

18.3 All witnesses and sureties shall be persons of status and probity and their full names, occupations and addresses shall be stated below their signatures.

19 Alternative Proposal by Tenderers

19.1 Tenderers shall submit offers that comply with the requirements of the Tender documents, including the basic technical design as indicated in the drawing and specifications. Alternatives will not be considered.

D. SUBMISSION OF TENDERS

20 Submission of Tenders

20.1 All Tender Proposals digitally signed along with the other Qualifying documents should be submitted Electronically through Karnataka Public Procurement Portal on or before the last date and time for Tender submission as published therein.

20.2 Tenderer, in advance, should get ready the proposal documents to be submitted as indicated in the Tender document / schedule in PDF /JPEG formats.

20.3 Tenderer should log into the portal well in advance for the submission of the proposal so that it gets uploaded well in time, i.e. on or before the last date & time for Tender submission. Tenderer will be solely responsible for any delay due to other issues.

20.4 The Tenderer has to digitally sign and upload the required proposal documents one by one as indicated in the tender document.

20.5 The server time (which is displayed on the dashboard) will be considered as the standard time for referring the deadline for submission of the proposals by the Tenderers, opening of proposals etc. The Tenderers should follow this time during proposal submission.

20.6 The necessary certificates/documents in support of fulfilling eligibility criteria and Technical requirements shall be scanned and attached to e-Procurement portal.

20.7 **Original documents to be submitted in hardcopy:**

The Tenderer shall seal and submit the original documents listed in ITT clause 13.2 in original (hard copy) by speed post or in person at BMRCL office within **5 days** of last date of online Tender submission. Only the tender(s) submitted & accepted online, the hardcopies will be considered for evaluation. The Hardcopies should carry/accompany copy of "soft copy submitted time and acceptance acknowledgement from Employer / e-Procurement Portal".

The envelope shall bear the following identification:

TENDER NO. ……..

ORIGINAL SUBMITTALS OF QUALIFICATION CUM TECHNICAL PACKAGE

BMRCL Office Address for submission of hard copy:

The Chief Engineer (U/S),
Bangalore Metro Rail Corporation Limited,
III Floor, BMTC Complex,
K.H. Road, Shanthinagar,
Bangalore-560 027,
Karnataka, India.

The Tenderer can submit the hard copies by speed post or in person at the above address during 11.00 am to 5.00 pm on all working days. In case, 5th day happens to be a holiday then the next working day shall be considered as last day for submission of the hard copies.

20.8 All Tenderers have to submit "unconditional Tenders and without any deviations", together with requisite Tender Security/EMD.

21 Deadline for Submission of Tenders

21.1 Tenders must be submitted online through Karnataka Public Procurement Portal on or before the date & time as specified in the Portal and in time submission of tender is the responsibility of the Tenderer. Original Document (Hard Copy) as listed under ITT 13.2 shall be in the place, date & time as specified in ITT 20.7.

21.2 BMRCL may, at their discretion, extend the deadline for submission of tenders by issuing an amendment in which case all rights and obligations of BMRCL and the Tenderers previously subject to the original deadline shall thereafter be subject to the new deadline as extended.

22 Late or delayed Tenders

22.1 In online e-Procurement Portal, the Tenderer shall not be able to submit the Tender after the last date and time for Tender submission as the icon for the task in the e-Procurement Portal will be disabled.

Hardcopies (as per ITT clause 13.2) received by BMRCL after the deadline for submission as mentioned in ITT clause 20.7 will be rejected.

23 Modification and Withdrawal of Tenders

23.1 Tenderer may modify and correct or upload any relevant document in the portal till Tender submission date and time as published in the e-Procurement Portal.

23.2 No Tender shall be modified subsequent to the deadline for submission of Tenders.

23.3 Withdrawal or modification of a Tender during the intervening period between the deadline for submission of Tenders and the expiration of the period of Tender validity specified by the Tenderer in the Tender Form will result in forfeiture of Tender Security/EMD pursuant to ITT Clause 16.

E. TENDER OPENING AND EVALUATION

24 Tender Opening and Evaluation

24.1 Qualification Cum Technical Package:

24.1.1 Opening of Qualification Cum Technical Package (Technical Bid/Tender) of all Tenders:

Employer will open the Qualification Cum Technical Package (Technical Bid/Tender) of all the Tenders received through e-procurement Portal at the time and date fixed for Technical Bid. Before opening the Technical Bid of a Tenderer, the Employer will verify the EMD first. If EMDs are not in proper form, the technical Bid will not be opened for such tenderers. Interested tenderers or their authorized representatives who choose to attend or may view the same on the portal on the scheduled date and time from their end. In the event of the specified date for Tender opening being declared a holiday by the Employer, the Tenders will be opened at the appointed time and location on the next working day.

24.1.2 The Tenders will be examined for the following submittals:

i. Presence of valid Tender Security / EMD,
ii. Presence of Qualification cum Technical Package and all enclosures as per ITT clause 13.1 and,
iii. Submission of original documents as per ITT clause 13.2.

24.1.3 If any Tender contains any deviation from the Tender documents and /or if the same does not contain Tender Security in the manner prescribed in the Tender documents, then that Tender is liable for rejection. Incomplete Tenders in respect of above would be rejected.

Tenderers whose, Qualification cum Technical Package are found acceptable after evaluation would be informed of the date and time of opening of Financial Package through Portal.

24.2 Financial Package

The Financial Package of the Tenderers, whose Qualification cum Technical package were found acceptable, will be opened in the presence of those Tenderers or their representatives, who choose to be present and also can view the opening on e-procurement portal from their end. In the event of the specified date for Financial Package opening being declared a holiday by the Employer, the Tenders will be opened at the appointed time on the next working day.

The Tenderer's name, the Percentage rate (above or below or at par), Tender price, the total amount of each Tender, any discounts, Tender Modifications and Withdrawals, and such other detail as the Employer may consider appropriate, will be announced by the Employer at the opening.

Conditional Tenders are not acceptable and will be summarily rejected. The Employer shall prepare minutes of the Tender opening, including the information disclosed to those present and the minutes shall form part of the Contract.

25 Process to be Confidential

25.1 The Tender Invitation Documents and any addenda thereto, together with any further communications, are issued for the purpose of inviting Tenders only. The Tenderer shall not disclose any information contained in the documents or otherwise supplied in connection with this Tender invitation to any third party except for the purpose of preparing its Tender. The Tenderer shall maintain complete confidentiality till the Contract is awarded.

25.2 After the opening of Tenders, information relating to the examination, clarification, evaluation, Tenders and recommendations concerning the award of Contract shall not be disclosed to the Tenderers or any other persons not officially concerned with such process until the award of the Contract to the successful Tenderer.

25.3 Any effort by a Tenderer to influence BMRCL personnel or representatives on matters relating to Tenders under study in the process of examination, clarification, evaluation and comparison of Tenders and in decisions concerning award of Contract, may result in the rejection of the Tenderer's Tender.

25.4 The Tenderer shall undertake that it will treat as confidential all matters arising in connection with the Tender. The documents are issued only for the purpose of preparing and submitting the Tender offer in response to the invitation and not for any other purposes.

26 Clarification of Tenders

26.1 To assist in examination, evaluation and comparison of Tenders, BMRCL may ask Tenderers individually for clarification of their Tenders including breakdown of unit rates/prices. The request for clarification and the response shall be in writing, but no change in the price or substance shall be permitted except conforming clarifications sought.

26.2 No Tenderer shall contact the Employer on any matter relating to its Tender from the time of the Tender opening to the time the contract is awarded.

27 Examination of Tenders and Determination of Responsiveness

27.1 Prior to detailed evaluation of Tenders, the Employer will determine whether each Tender:

a. Is accompanied by the required Tender Security/EMD,
b. Has been properly signed by an Authorized signatory.
c. Meets qualifying criteria, and;
d. Is responsive to the requirements of the Tender documents.

27.2 For the purpose of this clause, a substantially responsive Tender is one, which conforms to all the terms, conditions and specifications of the Tender documents, without material deviation or reservation. The material deviation or reservation is one which affects in any substantial way the scope, quality or performance of the works, or which limits in any substantial way or is, inconsistent with the Tender documents, BMRCL's rights or the Tenderers obligations under the Contracts and the rectification of which, deviation or reservation would affect unfairly the competitive positions of other Tenderers presenting substantially responsive Tenders.

27.3 If a Tender is not substantially responsive to the requirements of the Tender documents, it will be rejected by BMRCL.

28 Correction of Errors

28.1 Tenders determined to be substantially responsive will be checked by BMRCL for any arithmetical errors in computation and summation, Errors will be corrected by BMRCL as follows:

a) Where there is a discrepancy between quoted rate of percentage above or below or at par in figures and in words, the percentage above or below or at par, in words will govern.

28.2 The total Tender price quoted will be adjusted by BMRCL in accordance with the above procedure for the correction of errors and the concurrence of the Tenderer shall be deemed and binding upon the Tenderer. If the Tenderer does not accept the corrected price of the Tender, his Tender will be rejected and will result in forfeiture of the Tender Security / EMD pursuant to ITT clause 16.

28.3 If the Successful Tenderers price, is seriously unbalanced or over priced in the opinion of the Employer, the Employer may require the Tenderer to produce detailed price analysis for any or all items and Sub-heads of the Bill of Quantities, to demonstrate the internal consistency of those prices with the construction methods and schedule proposed.

F. AWARD OF CONTRACT

29 Acceptance / Award of Contract:

29.1 The Employer will award the Contract to the Tenderer, who meets the Eligibility and Qualification Criteria, whose Tender has been determined to be substantially responsive and complete in accordance to the Tender requirements, and whose Evaluated Tender Price is determined to be lowest.

30 Right to Accept or Reject any or all Tenders

30.1 BMRCL shall not be bound to accept the lowest or any Tender or to assign reasons for non-acceptance of any Tender. BMRCL reserves the right to accept a Tender either in whole or part.

30.2 BMRCL reserves the right to award the Tender as single Contract or can split into part Contract as desired by BMRCL.

30.3 BMRCL reserves the right to accept or reject any Tender, to annul the Tendering process and reject all Tenders, at any time prior to award of Contract, without thereby incurring any liability to the affected Tenderer or Tenderers or any obligation to inform the affected Tenderer or Tenderers of the grounds for BMRCL action.

31 Notification of Award

31.1 Prior to the expiration of the Tender validity, BMRCL will notify the successful Tenderer by cable or Fax or Telex or Email. This letter (hereinafter and in the conditions of Contract called "Letter of Award") shall specify the amount which BMRCL will pay to the Contractor in consideration of the execution, completion, operation, maintenance and guarantee of the works by the Contractor as prescribed by the Contract (hereinafter and in the conditions of Contract called "The Contract price").

31.2 Until a formal agreement is prepared and executed, the Tender together with the written acceptance of the LOA shall constitute a binding Contract between both the parties.

31.3 No further correspondence will be entertained by BMRCL from the unsuccessful Tenderers.

32 Performance Security / Security Deposit

32.1 Within fourteen (14) days of issue of the Letter of Award (LOA) by BMRCL, the successful Tenderer shall furnish Security for an amount of **Ten (10) percent of the Contract price** in any one of the following forms to guarantee the faithful performance of the Contract:

a) Demand Draft or Pay Order or Banker's cheque payable at BENGALURU drawn in favour of Bangalore Metro Rail Corporation Limited, on any Indian Nationalized Bank located in India.

OR

b) Bank Guarantee issued by an Indian Scheduled Bank (excluding Co-operative Banks) or from a Scheduled Foreign Bank as defined in Section 2(e) of RBI Act 1934 read with Second Schedule drawn on and payable/Extendable at a designated branch in Bangalore as per the format given in Annexure-C of Section VI.

The Bank Guarantee shall be valid for a period of three (3) months beyond completion of Warranty period.

No interest shall be paid on Performance Guarantee.

32.2 Not used.

32.3 Not used .

32.4 **Additional Performance Security**

After evaluation of the price analysis, taking into consideration the schedule of estimated contract payments, the Employer may require an Additional Performance Security, at the expense of the successful Tenderer to a level sufficient to protect the Employer against financial loss in the event of default of the successful Tenderer under the Contract, as specified below:

i. If the tender price offered by the successful Tenderer is lower than 10% but up to 20% of the estimated cost, then the additional performance security shall be calculated at 10% of the difference in the:
   (a) Estimated cost (as mentioned in NIT) – 10% of the estimated cost and
   (b) The tender price offered by the lowest evaluated Tenderer.

ii. If the tender price offered by the successful Tenderer is lower than 20% of the estimated cost then the additional performance security shall be calculated at 15% of the difference in the;
   (a) Estimated cost (as mentioned in NIT) – 10% of the estimated cost and
   (b) The tender price offered by the lowest evaluated Tenderer.

If such an additional Performance Security is required by the Employer, the successful Tenderer shall furnish the same, failing which his tender shall be liable for rejection. The additional performance security shall be valid up to contract period in consideration or any extension or issuance of acceptance/taking over certificate whichever is later, and released to the contractor on completion of the work.

33 Signing of Agreement

33.1 Within twenty-one (21) days of notification of award of work, the successful Tenderer shall sign the Contract Agreement (Annexure – A of Section - VI) on a stamp paper of requisite value, purchased by him at his own cost.

33.2 Failure to execute the Contract Agreement within the said period may result in termination of Contract and award of the same to other agency/agencies at the risk and cost of the Contractor.

33.3 The Contract agreement shall be signed/executed by the duly authorized person to bind the Successful tenderer by notarized Power of Attorney.

34 Information Regarding any Relative of Contractor Employed in BMRCL

34.1 Should a Tenderer or Contractor have a relative employed in Managerial capacity in BMRCL or in case of partnership firm or Company incorporated under the Indian Company Law, should a partner or relative of the partner or a shareholder be employed in responsible position in BMRCL, the authority inviting Tender shall be informed of the fact at the time of submission of Tender. If such fact is suppressed at the time of Tendering and comes to light at any time after the acceptance of Tender, the Contract may be rescinded.

34.2 **Corrupt or Fraudulent Practices:**

34.2.1 The Employer requires that the Tenderers / suppliers / Contractors under this Contract, observe the highest standard of ethics during the procurement and execution of this Contract. In pursuance of this policy the Employer:

a. Defines, for the purpose of these provisions, the items set forth below as follows:

i) "Corrupt Practice" means the offering, giving, receiving or soliciting of anything of value to influence the action of a public official in the procurement process or in Contract execution; and

ii) "Fraudulent practice" means a misrepresentation of facts in order to influence a procurement process or the execution of a Contract to the detriment of the Employer, and includes collusive practice among Tenderers (prior to or after Tender submission) designed to establish Tender prices at artificial non-competitive levels and to deprive the Employer of the benefits of free and open competition.

b. Will reject a proposal for award of work if he determines that the Tenderer Recommended for award has engaged in corrupt or fraudulent practices in competing for the Contract in question.

c. Will declare a Tenderer ineligible, either indefinitely or for a stated period of time to be awarded a Contract/ Contracts if he at any time determines that the Tenderer has engaged in corrupt and fraudulent practices in competing for, or in executing the Contract.

34.2.2 BMRCL and each Tenderer submitting the Proposal shall comply with these conditions of Tender and in their dealings with each other, discharge their duties and obligations on time and with integrity and behave equitably, honestly and transparently.

35 One Tender per Tenderer

A Tenderer shall submit only one Tender. A Tenderer who submits or participates in more than one Tender will be disqualified. No Tenderer can be a Subcontractor while submitting a Tender in the same Tender process. A Tenderer, if acting in the capacity of Subcontractor in any Tender, may participate in more than one Tender, but only in that capacity.

36 Miscellaneous

36.1 The Contractor shall undertake not to enter into Subcontract with any other person or to transfer the Contract or any benefit there under to any person or firm without the prior written approval of BMRCL.

36.2 It is the responsibility of the Tenderer to check the documents on receipt for completeness and notify BMRCL of any discrepancy or omission.

36.3 The Tenderer represents, warrants, and covenants that it will, throughout the term of performance of the Work under this Contract, maintain all required license status, professional ability, skills, and capacity to perform its obligations hereunder and will perform them in accordance with the requirements of the Contract Documents. The Contractor further represents and warrants that it can successfully perform the Work in conformity with Contract Documents and comply with all applicable laws, rules and regulations.

36.4 BMRCL reserves the right to request the Tenderers to make a presentation of their module or mode of carrying out the work and any such presentation shall be made at their own cost, risk and liability.

36.5 It is the responsibility of the successful Tenderer to make his own arrangements for obtaining necessary licenses, permits, clearance, from BESCOM, BBMP, BWSSB, Traffic police, Bharath Sanchar Nigam Ltd, and any other stake holder etc.., except as specified in the Contract.

36.6 Tenderers are required to fill in all the blank spaces in the Form of Tender as per Section V.

36.7 The Tenderers shall be presumed to have carefully examined the drawings if any, conditions and specifications of work & to have fully acquainted themselves with all details at site, locations, materials, geological formations, weather characteristics, labour conditions etc; pertaining to the work.

36.8 The Tenderers shall abide by all rules / acts in force with regard to safety, environment, worker's, transportation, etc. for carrying out the work in safe and efficient manner.

36.9 While all efforts have been made to avoid errors in drafting this tender documents the Tenderer is advised to check the same carefully and seek clarifications within the stipulated period only. No claim on account of any errors detected in the tender document shall be entertained.

36.10 Tenderer shall have adequate erection facilities and capacities. The Tenderer shall have quality assurance plan for procuring of materials, supply, installation, testing and commissioning.

36.11 Tenders shall be submitted for whole of the works defined in the Tender document. Tenders not covering the entire specified scope of work shall be treated as incomplete and rejected.

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SECTION – III

GENERAL CONDITIONS OF CONTRACT (GCC)

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SECTION – III : GENERAL CONDITIONS OF CONTRACT

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SECTION – III: GENERAL CONDITIONS OF CONTRACT

1 Definition of terms

1.1 In these general conditions, the following expressions shall be the meanings herein assigned to them, unless there is something in the subject or context inconsistent with such meaning.

1.2 **"BMRCL or Employer or Owner or Company or Purchaser"** shall mean the **"BANGALORE METRO RAIL CORPORATION LIMITED"**, which has jurisdiction over the area of works, and its successor if any.

1.3 **"Division"** shall refer to the respective office of BMRCL directly in charge of the works.

1.4 **"Contractor"** shall mean the successful Tenderer whether a firm, registered company, partnership or an individual, whose Tender has been accepted by BMRCL or by the Officer duly authorized on behalf of BMRCL, and who has entered into agreement with BMRCL for due fulfillment of the Contract and shall also include legal representatives, successors and assignees of the Tenders.

1.5 **"Engineer"** means the Officer of BMRCL in charge of the works or such other officer who may be appointed to act as the Engineer for the purpose of this Contract and shall also include the Chief Engineer/ Executive Engineer/ Assistant Executive Engineers or Officers of equivalent rank, directly in charge of the work authorized by BMRCL. The Contractor shall have the right of appeal against the orders of a lower ranked authority to the higher ranked authority of BMRCL whose decision shall be final and legally binding on all parties concerned.

1.6 **"Engineer–in-charge"** shall mean the Engineer of the concerned jurisdiction or his duly authorized officers.

1.7 **"Plant"** shall mean and include any or all plant, machinery, tools or other implements of all description necessary for the execution of the work in safe and workman like manner.

1.8 **"Work or Works"** shall mean the work or works set out and described in the Schedule of prices, drawings and specifications and which the Contractor has agreed to execute under the terms of Contract. It shall include all items of work, which unless specially excluded are necessary to execute the work as described.

1.9 **"Contract and Contract documents"** shall mean and include the General conditions of Contract, Special conditions, Specifications, Schedule of Prices, drawings and the stamped agreement.

1.10 **"Specifications"** shall mean the specifications annexed and such other specifications and the Schedule of drawings if any, as may be detailed and necessary due to particular nature of works wherever applicable i.e. specifications and construction practices published by the BBMP/BESCOM/KPTCL/Rural Electrification Corporation of India shall be applicable.

1.11 **"Site"** shall mean and include all the area in which operations in respect of the works are carried out. These terms shall also include material stacking yard and the area where temporary structures are put up for installing any machinery etc.

1.12 **"Month"** shall mean a month as reckoned by the English Calendar.

1.13 Words used in singular shall also include the plural and vice versa where the context so demands.

1.14 Word indicating one gender includes all gender.

2 Contractor to inform himself fully

2.1 The Contractor shall be deemed to have carefully examined the Contract documents and to have visited the site and fully acquainted himself with the conditions of labour, roads, work, climate, rainfall, type of soil etc., prevalent in the area. Any information available with BMRCL regarding the site conditions will be made available to the Contractor, but BMRCL will not accept any responsibility for the accuracy thereof or the inference that may be drawn there from.

2.2 The Contractor shall in writing get necessary clarifications from the Engineer-in-charge in respect of the meaning of any of the conditions set forth in the Contract documents.

3 Contractor's representative and labour

3.1 The Contractor under intimation to the Engineer shall employ at least one competent representative with a minimum qualification of Diploma in Electrical Engineering duly approved by the Engineer- in – charge to carry out and supervise the works on behalf of the Contractor. The said representative or any one of such representatives, if there be more than one shall be present at the site during working hours, and any written orders or instructions given to such a representative by the Engineer-in-charge, shall be deemed to have been lawfully given to the Contractor.

3.2 The Contractor shall at all times employ labour of every description as the Engineer-in-charge may deem necessary for securing the proper progress of the works and shall on demand furnish from time to time such returns as may be required of the number and description of unskilled, skilled and supervisory staff actually engaged for the work.

3.3 The Contractor shall furnish the Engineer-in-charge with such reports as he may be required regarding the progress of the works and the organization in connection with the execution of the work.

3.4 The Engineer-in-charge has the right to object to the employment or presence of any representative or other persons or labour employed by the Contractor on the grounds of incompetence, negligence, misconduct and upon such objection being raised, the Contractor shall be bound to remove or cause to remove such person or persons and provide competent substitutes approved by the Engineer-in-charge. The Contractor shall not be entitled to any damage or loss that may be caused by such action of the Engineer-in-Charge.

3.5 **Subcontracting**

The Contactor shall not, without the previous written consent of the Engineer assign or Subcontract his Contract or any part thereof except for minor works. Any such consent given by the Engineer shall not relieve the Contractor from any obligations, duty or responsibility for all or any action of the Subcontractor as if those actions are committed by the Contractor himself.

Any breach of this clause shall entitle the Employer to rescind the Contract and render the Contractor liable for loss or damage arising due to termination.

4 Works - general information

4.1 The Contractor shall execute the works on "**TURNKEY BASIS"** which involves broadly the supply and transportation to works site, assembly, erection, testing and Commissioning of lines and equipment, backfilling and consolidation and returning the released materials to the respective stores of BMRCL or the owners of the assets as decided by BMRCL.

4.2 The details of equipment to be supplied, transported, assembled, erected, tested and commissioned in each package are indicated in the Financial Package. The quantities indicated in Schedule of Prices are only approximate & during the execution of the Contract, BMRCL reserves the right to increase or decrease the quantities of items under the Contract in accordance with the conditions of Contract.

4.3 Before finalizing the orders for purchase of materials the Contractor shall undertake survey of the works to be carried out and make a reliable estimate of the actual quantity of each material required for the intended works. The Engineer-in-charge shall arrange to facilitate the Contractor by furnishing the details of the works and route profile etc., as may be required for the purpose, including deputing of BMRCL officers to the extent deemed necessary by him. However, delay if any in this regard shall not constitute a valid ground for delay in completion of works.

4.4 Any other items of work not specifically mentioned, but which are essentially required for satisfactory performance & completeness of the works shall be deemed to be included in the scope of works and the same shall be executed / carried out by the Contractor.

4.5 The whole of the works together with any temporary works associated therewith shall be carried out by the Contractor in a satisfactory and workmanship like manner with the materials and workmanship as specified to the entire satisfaction of the Engineer-in-charge, and in such a manner as the Engineer-in-charge may direct. The Contractor shall attend to and carryout without any delay all orders and instructions which the Engineer-in-charge may issue from time to time.

4.6 The whole of the works shall be executed in strict conformity with the Contract documents and such explanatory, detailed or modified drawings and directions as may be furnished from time to time by the Engineer-in-charge for the guidance of the Contractor.

4.7 In case of any defect in material supplied or the work carried out or both noticed by BMRCL/Contractor during execution of the work or during the period of Performance Guarantee, the Contractor shall replace the defective material and redo the defective work to the satisfaction of Engineer-in-Charge or the authorized officer of BMRCL / BBMP / BESCOM.

4.8 The Contractor shall be deemed to have satisfied himself as to the correctness and sufficiency of the Contract Price. The Contract Price shall cover all his obligations under the Contract and all things necessary for the proper execution and completion of the Works, testing and commissioning and remedying of any defects.

4.9 Contractor shall take full responsibility for adequacy of safety and security of the Works. He shall also have full regard for safety of all persons on or in the vicinity of the site.

4.10 The Contractor shall take all reasonable steps to protect the environment and to avoid injury, damage and nuisance to people and property resulting from pollution, noise and other results of his operations. The Contractor shall ensure that air emissions, surface discharges and effluent from the Site during the Contract Period shall not exceed the values prescribed by law.

4.11 It shall be the responsibility of the Contractor to provide at his own expense the required sheds, store houses and yards for execution of the Works and provide free access to the Engineer or his Representative/s who will have right of inspection including that of instructing the Contractor to remove a particular material from the stores and not to use the same on the Works.

5 Local Conditions

5.1 It will be imperative for each Contractor/ Tenderer to fully inform himself of all local conditions and factors, which may have any effect on the execution of the works and services covered under these documents and specifications.

5.2 It must be understood and agreed that such factors have properly been investigated and considered while submitting the Tender. No claim what so ever including those for financial adjustment to the Contract awarded under these specifications and documents shall be entertained by BMRCL. Further, no change in the time schedule of the Contract or any financial adjustment (s) arising thereof shall be permitted by BMRCL, which are based on the lack of such clear information.

6 Drawings

6.1 Unless otherwise provided for in the Contract, the Engineer-in-charge shall furnish to the Contractor, free of charge copies of drawings, and specifications as may be considered by the Engineer-in-charge to be reasonably necessary for the execution of the work.

6.2 Drawings, specifications and copies thereof furnished by the Engineer-in-charge shall not be used for other works and shall be returned to the Engineer-in-charge, on completion of the works. Drawings, specifications or other Contract documents shall not be reproduced or caused to be reproduced, without the previous written permission of the Engineer-in-charge.

6.3 All the drawings required for execution of work shall be got approved from BMRCL Authorities before execution of work.

7 Contract includes all necessary operations

7.1 The Contract includes the whole of the works which are described herein or implied by the Contract documents or which may be inferred to be obviously necessary for the efficiency, stability and completion of the permanent works and the performance of all operations and the supplying of all materials and things described in or implied by the Contract documents or which may be deemed necessary for the completion of the works in all respects to the complete satisfaction of the Engineer-in-charge, shall be deemed to be included in the Contract.

7.2 Works shown upon drawings without being mentioned or described in the specifications or shall nevertheless be held to be included in this Contract in the same manner as if they had been expressly shown upon the drawings and described in the specifications also.

8 Discrepancy between drawings and specifications

8.1 In case of errors, omission and / or disagreement between the written and scaled dimensions on the drawings or between the drawings and specifications, the Contractor shall make a reference to the Engineer-in-charge, whose elucidation or decision shall be considered authentic. For any error in the work due to such errors or omissions or disagreements, if he fails to refer them to the Engineer-in-charge, and get elucidation before starting the work, or specific part of the work executed, he shall himself be liable for the consequential losses, if any.

9 The contractor shall supply and be responsible for the efficiency of the means employed.

The Contractor shall supply and bear responsibility for procuring all materials, plant, Labour, scaffolding, timbering, machinery, tools and other implements and generally all means required for the `fulfillment of the Contract, whether such means be or not be recommended by the Engineer-in-charge. No materials, plant, tools, tackles or equipment brought to the site for use on the works shall be removed from the site without previous written permission of the Engineer-in-charge.

10 Watch and ward

Except as may be specifically provided the Contractor shall be responsible for all proper watch & ward of all works comprised in the Contract & for providing necessary temporary footways & fences etc.

11 Safety Devices

The Contractor shall at his own cost provide such safety devices, like steel or fiber glass helmets, slings, ropes, belts, covering for legs and hands, masks, etc., for the safety of personnel and glow tapes, glow signs, barricades, etc., for the safety of public, commuting near the work place. when working underground or in water or when handling cement, or working on steep slopes etc., and as the Engineer-in-charge may direct in the interest of safeguarding the workmen from liability to accidents or damages to health and to carry out such measures as the Engineer-in-charge may prescribe in this behalf. The Contractor shall be responsible for the workmen employed by him or third party in case of accidents or damages resulting in bodily injury or affecting their health and to carry out such instructions regarding preventive or safety measures as the Engineer-in-charge may prescribe on this behalf. The Contractor shall also be solely responsible for the adequacy of the strength and design of scaffolding, gangways, and notice board etc., erected for the execution of the works. All the works shall be in conformity with all the laws prevailing on the land.

12 Agreement and Performance Security

12.1 Within a period of **Fourteen** (**14) days** or such other period as may be mentioned in the letter of notification of award of the Tender, the Successful Tenderer shall furnish the required Performance Security and shall enter into an Agreement with BMRCL within Twenty-one (21) days of Notification of Award of works according to the conditions of the Contract on Karnataka Government Stamp paper of requisite value as per the format enclosed at Annexure-A. The cost of the stamp duties and similar charges imposed by law shall be borne by the contractor.

12.2 Performance Security is a deposit with BMRCL of an amount equal to **Ten (10) percent of the Contract Price.** The Performance Security shall be in the form of:

a) Demand Draft or Pay Order or Banker's cheque payable at Bengaluru drawn in favour of Bangalore Metro Rail Corporation Limited, on any Indian Nationalized Bank located in India.

OR

b) Bank Guarantee issued by an Indian Scheduled Bank (excluding Co-operative Banks) or from a Scheduled Foreign Bank as defined in Section 2(e) of RBI Act 1934 read with Second Schedule drawn on and payable/Extendable at a designated branch in Bangalore as per the format given in Annexure-C of Section VI. The Bank Guarantee shall be valid for three (3) months beyond the date of completion of Warranty period.

12.3 Failure of the successful Tenderer to furnish the required Performance Security shall be a ground for the annulment of the award of Contract and forfeiture of the Tender Security / EMD pursuant to ITT clause 16.

12.4 The whole or such portion of the Performance Security amount as he may consider fit shall be liable to be forfeited by the Employer at the discretion of the Employer, in the event of any breach of Contract on the part of the Contractor.

12.5 In the event of variations during the execution of the Contract which result in payments to the Contractor over and above the original Contract Price, the Performance Security shall be suitably adjusted every 6 months at the request of the Employer.

12.6 All expenses incurred for completing and stamping the Contract Agreement shall be borne by the Contractor. The stamped Agreement shall be deposited with BMRCL and a copy of the Agreement signed by both parties shall be delivered to the Contractor.

12.7 After the Tender has been accepted by BMRCL or by any Officer duly authorized by BMRCL to accept the Tender, all orders and instructions to the Contractor, except as herein otherwise provided, will be given by the Engineer-in-charge, on behalf of BMRCL.

12.8 In case the validity of the Bank Guarantee for performance of Contract is to be extended for any reason, the Contractor shall get the validity extended and the cost of which shall be borne by the Contractor.

12.9 The Performance Security shall be released after completion of the entire work, commissioning, handing over and completion of all Contractual obligations including Warranty period, whichever is later.

13 Liability for accidents to persons

13.1 The Contractor shall be solely responsible for all accidents to persons employed by him, which may arise in the execution of the works, and from whatever cause they may arise during execution and maintenance of works included in the Contract and shall arrange for insurance as prescribed in the Tender document.

13.2 The Contractor shall indemnify BMRCL against all action, suits, claims, demands, cost of expenses arising in connection with injuries suffered upto the date when the works or plant shall have been taken over under and of the clauses herein by persons employed by the Contractor or his Subcontractor whether under the general law or under the Employee's compensation Act or any other statute in force on the date of the Contract dealing with the question of the liability of employee from injuries suffered by employees and to have taken steps properly to ensure against any claims there under.

13.3 On the occurrence of accidents which result in the death of the workmen employed by the Contractor or which result in injury so serious as to be likely to result in the death of any such workmen, the Contractor shall within 24 hours of happening of such accident, intimate in writing to the concerned Engineer-in-charge, the details of such accidents. The Contractor shall indemnify BMRCL against all loss or damages sustained by BMRCL resulting directly or indirectly from Contractors failure to give intimation in the manner aforesaid or otherwise to confirm to the provision of the Employee's compensation Act, in regard to such accident. In the event of any claim being made or action brought

against BMRCL due to negligence of the Contractor and arising out of the matter there of the Engineer in-charge of BMRCL shall assist, if so required, but at the sole expense of the Contractor, and, he may conduct all negotiations for the settlement of the case or any litigation that may arise there from. In such cases, BMRCL shall at the expense of the Contractor extend all available assistance for any such purpose.

13.4 In the event of any accident in respect of which compensation may become payable under Employee's Compensation Act, whether by the Contractor or by BMRCL as Principal, it shall be lawful for BMRCL to retain out of money due and payable to the Contractor such sum or sums of money as may be in the opinion of the said Engineer-in-charge, sufficient to meet such liability. Any balance left out of money so retained after meeting such liability shall be refunded to the Contractor.

13.5 The Contractor shall at all times indemnify BMRCL against all claims for damages or compensation under the provisions of payment of Wages Act – 1936, Minimum Wages Act -1948, Employers Liability Act – 1938, the Employee's Compensation Act – 1923, Industrial dispute Act – 1947, Indian Factories Act- 1948, Contract Labour Act – 1970, Maternity Benefit Act – 1961 or any modifications thereof made therein from time to time.

13.6 The Contractor shall bear the liability of all the risks and insurance and BMRCL shall not be responsible for any liabilities, whatsoever in any way.

13.7 The Contractor shall deliver the policies / Certificates of Insurance to the Engineer-In-charge for approval before commencing the work.

14 Liability for damage to works or plant

14.1 The Contractor shall during the progress of the works properly cover up and protect the work place and plant leased by BMRCL from injury by exposure to weather and shall take every reasonable proper and timely precautions against accidents or injury to the same from any cause, and shall be answerable and liable for all accidents or injuries resulting there from or occasioned by the Acts or omissions of the Contractor or his workmen or Subcontractor and shall indemnify the employer for all losses and damages to the works or plant arising from such accidents or injuries.

15 Labour conditions

15.1 The Contractor shall comply with the labour laws in force and shall furnish the returns and information as may be specified from time to time. He shall not employ or engage migrant labourers without express permission of the Engineer- in- charge.

15.2 The Contractor shall as far as possible obtain his requirements of labour from the local area, and through the employment exchanges wherever so required by law. The Contractor shall pay fair and reasonable wages as prescribed under Minimum wages Act 1948 (whether or not such wages are controlled by any law existing at the time) to workmen employed by him for the work

15.3 The Contractor shall provide at his own cost, suitable shelters at the work spot for meals and arrange for supply of clean, safe, potable water to his workmen. Where women are employed in numbers more than 50 at a spot, the Contractor shall arrange for "Crèches". The Contractor may be permitted, if he finds it necessary, to work on Sundays subject to the provisions of labour Act with the prior consent of the Engineer-in-charge and after giving the intimation at least two days in advance.

16 Medical facilities for labourers

16.1 The Contractor shall arrange to build at his own cost proper camp for his labourers and provide such camps with facilities of clean potable treated water and light (where ever possible) and arrange for drainage and proper disposal of sewage. He shall abide by the rules framed on this behalf by the Engineer-in-charge or the Health Office / Environment officer on the project.

16.2 The Contractor shall also provide at his own cost for the Medical supervision of his workmen against epidemics & arrange for taking anti malaria measures, vaccination against small pox, typhoid, cholera, etc., and examination of persons employed.

16.3 The Contractor shall also at his own cost provide for first aid at the work spot and for medical aid at his main camp to all his employees as directed by the Health Officer / Environment Officer and submit reports regarding such conditions in the camps.

17 Materials, workmanship etc.,

17.1 The work shall be executed in a thoroughly standard manner with materials and workmanship of the best quality and strictly in accordance with the specifications and drawings or written instructions as may from time to time be furnished to the Contractor and shall be completed in every respect with all materials and workmanship implied and necessary according to the fair interpretation and meaning of the same. Should there be any discrepancy between the drawing and specifications or any difference or dispute as to the dimensions to be worked to or the periodical quantity to be executed or with respect to any subject arising out of this Contract, the decision of the Engineer-in-charge shall be final and binding on all parties.

18 Material Procurement:

The Contractor shall procure the materials from BESCOM/ KPTCL/BMRCL approved vendors only conforming to the Guaranteed Technical Specifications/Parameters as laid out by BMRCL/BESCOM.

19 Contractor to inform engineer-in-charge the arrangements made by him for the execution of work.

19.1 The Contractor shall furnish schedule of work and the CPM/PERT chart in / MS Project for carrying out the work and the same shall be followed during execution.

19.2 The Contractor shall furnish the Engineer-in-charge a statement in writing of the arrangements he proposes to adopt for the execution of the work and in case the Engineer-in-charge considers any alterations in the same desirable, the Contractor shall on notice thereof adopt such alteration.

19.3 The Engineer-in-charge and his authorized assistants or agents shall have, at all times, full power to inspect the works wherever in progress either on the site, or at the Contractor's premises wherever situated on the premises of any firm or company where work in connection with this Contract may be done and the Contractor shall provide all reasonable facilities and safety devices, at his own cost, for enabling such an inspection of works to be carried out, and any tests to be conducted if necessary. The Contractor shall maintain at such work spot a Work Order book, in which the instructions in the said Work Order, shall be promptly noted and sent to the inspecting Officer and provide a copy of the same to the Engineer-in-charge.

20 Opening out of the works

Should the Engineer-in-charge consider it necessary in order to satisfy himself as to the quality of work, the Contractor shall at any-time during the execution of the work, pull down or cut into any part of the work and make such openings into and to such an extent through the same as the Engineer-in-charge may direct and the Contractor shall make good the whole of Work at his own cost.

21 Removal of imperfect work

21.1 If any work has been executed with unsound, imperfect for unskilled workmanship or with materials of any inferior quality not in accordance with the specifications and drawings, the Contractor shall at his own cost rectify, reform, remove and reconstruct the same either in whole or part as may be directed by the Engineer-in-charge, whether or not the value of any such work (or materials) shall have been included in any payment made to the Contractor.

21.2 Should the Engineer-in-charge consider in his unfettered discretion that he could accept a work which is not strictly in accordance with the Contract documents but is structurally sound and would serve the purpose for which it is executed, he may fix a price less than that Contracted for, and his decision regarding the acceptance and the reduced price to be paid for, shall be final and binding on the Contractor.

22 Suspension of work

22.1 The Engineer-in-charge may from time to time by direction in writing without in any way vitiating the Contract, direct the Contractor to suspend the works or any part thereof at such time or times and so long as the Engineer-in-charge may deem desirable, and the Contractor shall not after receiving such written notice proceed with the works therein ordered to be suspended until he shall have received a written notice or authority from the Engineer-in-charge to proceed with the works.

22.2 Should the works be ordered to be suspended directly or indirectly as a result of the Contractor not complying with any of the provisions of the Contract in respect of the quality of the materials, workmanship, progress, mode of execution, the order of execution etc., or in the interest of safety of the works, or due to acts of nature, force majeure or war, the Contractor shall not be entitled to claim any compensation for any loss he may be put to. If however, the works be ordered to be suspended for reason for which the Contractor is not responsible directly or indirectly he will be entitled to compensation as may be determined by the Engineer-in-charge whose decision in the matter shall be final. In such matters the profits that the Contractor would have earned had the work not been suspended shall not be taken into consideration.

23 Access to site and work on site

23.1 BMRCL may, if it deems fit from time to time, enter upon any land which may be in the possession of the Contractor under this Contract for the purpose of executing any works by itself or through its agents or through the other Contractors or workers of BMRCL at its option, and the Contractor shall in accordance with the directions of the Engineer-in-charge afford all reasonable facilities for the execution of the works, including the Occupation of lands by structures or otherwise for any Contractors or their workmen or for BMRCL- workers who may be employed in the execution of Works, on or near the site of work not included in this Contract or any Contract in connection with or ancillary to such work and in default the Contractor shall be liable to compensate BMRCL for any delay or expense incurred by the reason of such default. Provided always that if the exercise of these

powers, shall cause any damage to the Contractor he may as and when damage shall arise make a statement of the same to the Engineer-in-charge who shall from time to time certify to BMRCL, the value in his judgment of such damage & BMRCL shall from time to time pay the Contractor the amount if any so certified by the Engineer-in-charge.

24 Deviations, alterations etc., in the works

24.1 The Contractor shall not in any way alter any part of the work in respect of design, quantity, material or specification, without the written consent of the Engineer-in-charge, but the Engineer-in-charge may from time to time or at any time during the progress of the works direct in writing any deviations, addition, omissions, or alterations, to be made in or to the works or any part thereof in respect of quantity, design, material, workmanship and or specifications and may direct the Contractor to curtail or omit any of the works or to commence and execute any new or substituted work in such order and manner as he may deem fit and any such direction of the Engineer-in-charge and any such deviation alteration, addition and omissions made in pursuance thereof shall not violate the Contract or be made the ground for any claim for compensation for alleged loss or profit in respect of omitted works or for extra rate of payment for additional works.

24.2 In the event of any disputes arising out of the validity of the claims or as to the amount to be paid or allowed in respect thereof, the decision of the Engineer-In-Charge shall be final and binding and in the mean while the Contractor shall either proceed with or stop the works as may be ordered by the Engineer-in-charge.

25 Measurement and terms of payments

25.1 The Contractor shall submit an invoice / Bill in quadruplicate (4 copies) to the Engineer-in-charge in prescribed form. Such Payment will be made after item wise measurements for different works as recommended by the Engineer-in-charge as per the Contract.

25.2 The payments to Contractor are subject to recoveries, which are due from the Contractor as indicated in Clause 26.7 of this section.

25.3 The authorized representatives of the Engineer-in-charge and the Contractor shall jointly take the measurements. The representative of the Engineer-in-charge will give a week's notice to the Contractor of his intention to record the measurement immediately on report of completion of all works by the Contractor and if the Contractor's representative fails to join the Engineer-in-charge representative, the latter may proceed with the measurements by himself and the Contractor shall have to accept these measurements as correct and binding on him.

25.4 On the basis of these joint measurements, payment will be made to the Contractor by the Engineer-in-charge according to the procedure prevalent in BMRCL and as far as possible within **28 working days** after submission of the bills & after recording the measurements as stated above.

25.5 Wherever approval of the Inspectorate authorities is required under statute, payment shall be made by the Contractor and reimbursed by BMRCL on production of bills/vouchers.

25.6 All materials and work for which payment is made in part or full shall become the sole property of BMRCL, but this provision shall not relieve the Contractor of his responsibility for the care and protection of the materials and works at his own cost and his liability to make good the damage if any unless and until the whole work is deemed to have been completed, commissioned and handed over to BMRCL, in accordance with the terms and conditions of the Contract.

25.7 The periodical measurements and payments will not entitle the Contractor to any claim that the works for which payment has been made are accepted as complete in accordance with the specifications, drawings or other Contract documents and in no way will curtail the right of the Engineer-in-charge to subsequently direct the removal of imperfect work or pay at a lower reduced rate, or to re-measure the works.

25.8 These periodical payments shall be treated only as advance on account to be adjusted finally after the works are finally measured on completion and the final bill is prepared.

25.9 The Contractor shall not be entitled to claim any interest upon any arrears or upon any balance, which may be found due to him at any time.

25.10 **Stages of payment:**

The terms of Payments will be as stated below:

(a) Sixty percent (60%) of the invoice price excluding the GST of the materials supplied to store/site on receipt after supply of Turnkey Materials subject to the Certification by the concerned Engineer-in-charge with submission of the following:

i) Contractor's Detailed Invoice.
ii) Pre-dispatch clearance certificate issued by the owner, prior to dispatch of the Consignment.
iii) Physical Verification Certificate by the site Engineers.
iv) Test Certificates.
v) The sub vendor's invoice/ delivery challan.
vi) Copy of the Certificate of Transit Insurance.
vii) Indemnity Bond and Storage Insurance.

(b) Thirty percent (30%) of the Ex-works material cost shall be paid based on erection, wiring of equipment and all other associated works in complete manner, ready for commissioning in all respect to the satisfaction of the Engineer-In-Charge.

The above Payment terms are subject to the following conditions stated herein below:

i) The Paying authority shall ensure before making any payment towards materials that the materials have been received at site.
ii) The work is going according to the plan.
iii) Notwithstanding anything contained to the contrary in the Tender documents, storage insurance for materials stored at the site by the Contractor shall be to the account of the Contractor alone and no amount whatsoever is payable by BMRCL.

(c) Balance Ten percent (10%) of Ex-works material cost shall be paid after commissioning of the works on Distribution Transformer Centre wise subject to the Certification by the concerned Engineer in charge and handing over to BBMP / BMRCL authorities.

(d) Labour charges for erection of equipments /cables laying, etc will be paid 100% on completion of the work, in all respects.

i) The Engineer-in-charge ensures that the work has completed in all respects as per Tender Conditions except Commissioning.
ii) On certification of the Engineer-in-charge after duly having joint Measurements along with the Contractor.

26 Taxes and duties

26.1 Contract prices shall be inclusive of all applicable taxes, duties and cess including taxes to be deducted at source, insurance and exclusive of SGST and CGST. BMRCL shall pay the SGST and CGST as applicable as per laws.

26.2 Income tax and other statutory deductions of the State & Central Government as applicable from time to time shall be made from the Contractor's Bills & directly remitted to concerned department by BMRCL. If the income tax is to be deducted at lower rate, then the Contractor has to furnish a lower deduction certificate issued by the jurisdictional IT authorities.

26.3 The Contractor shall maintain complete records in respect of payments made by them as required by law.

26.4 The Contractor shall furnish along with the 2nd and subsequent bills copies of all the purchases of Goods and Services made within the State of Karnataka.

26.5 BOCW cess at the rate of 1% of the Total Bill Amount as per "The Building and Other Construction Workers Cess act 1996" shall be deducted from each interim Payment Certificate (IPC) of the Contractor.

26.6 **NOT USED**

26.7 **Recoveries**

26.7.1 Recoveries due from the Contractor up to the end of the month previous to the one in which bill is prepared shall be made from the bills approved for payment every month in the following order of priority and extent.

a) Penalty, in full, if any to be levied.
b) Expenditure incurred by BMRCL on behalf of the Contractor in full.
c) Charges for services such as water supply, power etc., if any, rendered by BMRCL in full.
d) Statutory deductions like Income Tax etc;
e) Any recoveries or other sums due from the Contractor to BMRCL.

26.7.2 The extent of recovery to be made from the Contractor's bill may be modified at the discretion of the Engineer-In-Charge, if the bill under question includes items whose rates are not finalized or the rate for such items is not fully collected.

27 Date of completion

27.1 The works shall be completed in all respects within the period specified in Appendix to Form of Tender (Section V) including monsoon period.

27.2 The necessary PERT Chart duly indicating the completion of each stage of work on Individual sections and the total completion period according to delivery schedule shall be furnished, to the Engineer-in-charge.

27.3 The Contractor shall supply, erect, equip and construct the whole of the works to the satisfaction of authorities with all certification and hand them over to BMRCL O&M on or before the date or dates specified as incorporated in the Contract Agreement. Provided always that if, in the opinion of the Engineer-in-charge, any alteration, addition, subtraction or modification of the work due to any strike

or lockout of any workmen employed by the Contractor or by causes directly due to war or the unforeseen acts of nature or due to actions caused by BMRCL by issuing any orders, drawings, instructions or directions in time or by the suspension of work, the Engineer-in-charge, if in his discretion deem fit, either forthwith or at any later time and from time to time not withstanding that the prescribed or extended time for completion has expired or that the works have been completed, by writing extend the time for the completion of the work to such date as he may deem fit and proper, provided always that the Contractor makes a written application to the Engineer-in-charge at or before the time when the cause of the delay is occurring or about to occur or within three days from the occurrence of such delay. Unless the time is extended by the Engineer-in-charge, the prescribed time may not be extended not withstanding delays from the foregoing or any other cause of whatever kind. However, the Contractor shall not be responsible for delay due to accordance of approval by the Inspectorate. In such a case, where the Contractor is entitled for the extension of time, no monetary claims whatsoever shall be paid or entertained on this account.

27.4 The Employer shall give possession of all parts of the site progressively for the completion of works to the contractor, if, possession of part of the site is not given by the date stated in the contract or Notice to proceed / LOA, the reasonable extension of time may be given. However, no monetary claims whatsoever shall be paid to the contractor or entertained on this account. The delay in access to site shall not be considered as “Breach of Contract”.

28 Progress of work and failure to abide by the programme of work and penalties thereof

28.1 The time allowed for carrying out the work as per program shall strictly be observed by the Contractor as set out in the Tender document / agreement. The work shall throughout the stipulated period of Contract proceed with all due diligence, time being deemed to be the essence of the Contract on the part of the Contractor. If the Contractor at any stage of the progress fails to complete the work, the Engineer-in-charge shall be at liberty to adopt any one of the following courses after sending written notice to the Contractor.

28.2 To employ labour paid by BMRCL, to supply materials to carry out the work or any part of the work, debiting the Contractor with the cost of labour, transportation, price of materials etc., (as to the correctness of such cost and price, the decision of the Engineer-in-charge being final & conclusive against the Contractor) and crediting him with the value of work done in all respects in the same manner and at the same rates as if it has been carried out by the Contractor under the terms of his Contract and in that case, certificate of the Engineer-in-charge as to the value of the work done being final and conclusive against the Contractor.

28.3 In case the Contractor abandons the work or does not execute the work as per the Contract conditions, BMRCL would get the works executed by another agency at the “risk and cost” of the Contractor.

28.4 In order for the work of the Contractor to be measured and to take such part, thereof, as shall be unexecuted out of his hands and to give to another Contractor to complete the same in which any expense which may be incurred in excess of the same, which would have been paid to the original Contractor, if the whole work had been executed by him (as to the amount of which excess expenses,

the decision of the Engineer-in-charge shall be final and conclusive) shall be deducted from any money due to him by BMRCL under the Contract or otherwise from his Earnest Money, further Security Deposit etc.,

28.5 To allow the original Contractor to continue the work, levying the penalty as per rates noted below for the number of days that the Contractor takes to complete and deliver portion of the work which was scheduled to be completed as per program in the agreement.

29 Penalty for delay in execution of the work

29.1 The penalty shall be one (1) percent of the Original Contract Price per week of delay or part thereof subject to a maximum of 10% on the portion of work which is not completed for beneficial use within the time stipulated in clause 27 above.

a) The period(s) of continuance of delay, if any, beyond 10 weeks shall be at the sole discretion of the Engineer-in-charge. If the Contractor still fails to complete the work within such extension period, the Contractor shall be liable for paying the liquidated damages/penalty as decided by BMRCL.

b) Penalties levied for the following:

(i) Non-fulfillment of program of works within the stipulated period.

(ii) The number of days allowed beyond the stipulated period for completing the work and

(iii) Extra cost that might be incurred by BMRCL for getting the balance work completed through any other agency as it deems fit under the circumstances will be deducted from money due to him by BMRCL for work done under the Contract or otherwise.

c) The levy of penalty is however exempted, if extension of time granted for the execution of work for valid reasons.

30 Compliance with instructions

30.1 If the Contractor fails to work with diligence and expedition, or shall refuse or neglect to comply with any reasonable orders given to him in writing by the Engineer-in-charge in connection with the work or contrivances of the provisions of the Contract, BMRCL may give “seven days” notice in writing to the Contractor, to make good the failure, neglect or contravention complained of, and should the Contractor fail to comply with the notice within the specified time from the date of service thereof in the case of a failure, neglect or contravention, capable of being made good within that time or otherwise within such time as may be reasonably necessary for making it good, then and in such case BMRCL shall be at liberty to employ other workmen and forthwith perform such work as the Contractor may have neglected to do or if BMRCL shall deem fit it, shall be lawful to take over the work wholly or in part of the Contractor’s hands and reconstruct the work or any part and in that event, BMRCL shall without being responsible to the Contractor for the fair wear and tear of the same have the free use of all the materials, tools, tackle, construction plant or other things for use at any time in connection with the work to the exclusive of any right of the Contract over the same and BMRCL shall be entitled to retain and apply any balance amount which may be otherwise due on the Contract to the Contractor including Earnest Money, Security Deposit and retention money, if any, for the performance of the Contract, or such part thereof as may be necessary to the payment of the cost of executing such work as aforesaid.

31 Powers to take over plant and equipment to enforce progress

31.1 Notwithstanding anything contained in the clause herein above, if the Contractor fails to work with due diligence and speed or refuses or neglects to comply with any lawful and reasonable orders given to him in writing by the Engineer-in-charge or contravenes any of the provisions of the Contract, the Engineer-in-charge may give seven days' notice in writing to the Contractor to make good the failure, neglect or contravention complained of and should the Contractor fail to comply with the notice within the time specified in the notice, then in case the Engineer-in-charge shall be at liberty to employ other workmen and forthwith perform such work as the Contractor may have neglected to do, or if deemed fit, it shall be lawful for the Engineer-in-charge to take the work wholly or in part, out of the Contractors' hands and reconstruct it at a reasonable price with any other person or persons or provide any other materials, tools and tackle or labour for the purpose of completing the work and in such an event the Engineer-in-charge shall without being responsible to the Contractor for fair wear and tear, have the free use of all materials, tools, tackle, plant or other things including operating personnel which may be on the site for the use at any time in connection with the work to the exclusive of the right of the Contractor, over the same and the Engineer-in-charge shall be entitled to retain and appropriate and balance which may otherwise be due to the Contractor as may be necessary to the payment of the cost of executing such works aforesaid.

31.2 If the cost of executing the work as aforesaid exceeds the balance due to the Contractor and the Contractor, fails to make good the deficit, the said materials, tools, tackle, plant or other things, which were the property of the Contractor, may be sold by the Engineer-in-charge and the proceeds thereof applied towards the payment of such difference and cost of any incidental to such sale, shall be paid by the Contractor forthwith but when all expenses, costs and all charges incurred in the completion of the works are paid by the Contractor, all such materials, tools, tackle, construction plant or other things, remaining unsold may be allowed to be removed by the Contractor**.**

32 Termination of contract

32.1 BMRCL shall have the powers:

a) To recover from the Contractor as agreed liquidated damages or by way of penalty clause above and to purchase elsewhere/complete the works after giving due notice to the Contractor, on to the account and at the risk of the Contractor, such stores/works not so delivered/completed or others of a similar description without canceling the Contract in respect of the consignment/work not yet due for delivery, but the Supplier/Contractor shall not be entitled to any savings on such purchases/works made against default.
b) To cancel the Contract.
c) To forfeit Performance Security.
d) To blacklist or not to consider the Contractors future offers for a specified period or such other periods as decided by BMRCL.

32.2 **Termination for Convenience**

32.2.1 BMRCL may, by a written notice of 14 days sent to the Contractor, terminate the Contract, in whole or in part at any time for its convenience. The notice of termination shall specify the termination is for BMRCL's Convenience, the extent to which performance of work under the Contract is terminated and the date upon which such termination is effective.

32.2.2 The Contractor upon receipt of such notice shall discontinue the work on the date and to the extent specified in the notice, make all reasonable efforts to obtain cancellation of all orders and the Subcontracts to the extent they are related to the work terminated and upon terms satisfactory to BMRCL.

32.2.3 After termination, the Employer (BMRCL) may complete the works and arrange for any other entities to do so at the risk and cost of the Contractor. The Employer and his entities then may then use the working area, Contractors documents and his any other related documents made by or on behalf of the contractor.

On termination of the Contractor's default, the Employer shall be entitled to:

a. Forfeit the whole or such portion of the Performance Security amount as it may consider fit, and
b. Recover from the Contractor the cost of carrying out the balance work in excess of the sum which he would have been paid according to the certificate of the Engineer, if the works had been carried out and completed by the Contractor under the terms of Contract. Such certificate shall be final and binding upon the Contractor. The amount to be recovered may be deducted by the Employer from any monies then due or which, at any time thereafter, may become due to the Contractor under this or any other Contract or otherwise.

33 Force majeure

33.1 For the purposes of the Contract "Force Majeure" means, an event which could not reasonably have been avoided by a diligent party in the circumstance, which is beyond the reasonable control of a party and which makes the performance of an obligation as to impossible in the circumstances and includes, but is not limited to, war, riots, civil disorder, earthquake, storm, flood or other adverse weather conditions strikes, lockouts or other industrial action, Electrical Grid failure, confiscation or any other action by Government agencies.

33.2 Force majeure shall not include any event, which is caused by the negligence or intentional action of a party or such party's Subcontractors or agents or employment, or by a failure to observe good Engineering practices.

33.3 Force Majeure shall not include insufficiency of funds or failure to make any payment required hereunder.

34 Completion & final certificate

34.1 As and when the whole work is completed to the satisfaction of the Engineer-in-charge in accordance with the conditions of this Contract, the Engineer-in-charge shall issue a Completion Certificate and the Engineer-in-charge shall take over the work included in the completion certificate.

34.2 The Contract shall not be considered as complete until a final certificate is issued by the Engineer-in-charge, to the effect that the Contractor has fulfilled all the obligations in the manner provided in the Contract not withstanding any previous entry on the works or taking possession of works or using any part of the work by BMRCL. Final completion certificate shall be issued within one month soon after handing over of completed work and return of all the released material to BMRCL, physical completion/Commissioning of the work and submission of final as built drawings by the contractor duly attested by BMRCL Engineer In-charge.

35 Guarantee of works

35.1 For a period of Twelve (12) months from the date of issue of the completion certificate herein above mentioned, the Contractor shall be liable for the works or any portion thereof found to be defective for causes arising from faulty materials or workmanship or other causes for which in the judgment of BMRCL, the Contractor is responsible. He shall make good any damages arising there from, notwithstanding the fact that the completion certificate may have been issued and the security deposit refunded.

36 Death, bankruptcy etc.

36.1 If the Contractor dies or becomes bankrupt or being a firm commences winding up except for reconstruction purposes or carries on its business under a receiver, the executors, successors or other representatives in law, the liquidator or any person in whom the Contract may become vested, shall forthwith give notice thereof in writing to the Engineer-in-charge and shall take all reasonable steps to prevent stoppage of works for one month during which period he shall guarantee as the Engineer may require but not exceeding the period of option in the event of stoppage of works, the period of option shall be fourteen days only. Provided that, should the above option not be exercised, the Contract may be terminated by the Engineer and any money pending with BMRCL may be forfeited, except in case of termination caused by the death of the Contractor.

37 Insurance

37.1 The Contractor at his Cost shall arrange, secure and maintain all Insurance as may be pertinent to the Works and obligatory in terms of law to protect his interest and interests of the Owner against all perils detailed herein. The form and the limit of such Insurance as defined herein together with the under-writer in each case shall be acceptable to the Owner. However, irrespective of such acceptance, the responsibility to maintain adequate Insurance Coverage at all time during the period of Contract shall be of Contractor alone. The Contractor's failure in this regard shall not relieve him of any of his Contractual responsibilities and obligations. The Contractor shall, however, be authorized to deal directly with Insurance Company or Companies and shall be responsible in with regard to maintenance of all Insurance covers. Further the Insurance in Indian Rupees.

37.2 Any loss or Damage to the Equipment during handling, transportation, Storage, Erection, putting into satisfactory operation and all activities to be performed till the successful completion of Commissioning of the Equipment shall be to the account of the Contractor. The Contractor shall be responsible for preference of all Claims and make good the Damages or loss by way of repairs and/or replacement of the Equipment, Damaged or lost. The transfer to title shall not in any way relieve the Contractor of the above responsibilities during the period of Contract. The Contractor shall provide the Owner with copy of all Insurance policies and Documents taken out by him in pursuance of the Contract. Such copies of Documents shall be submitted to the Owner immediately after such Insurance coverage. The Contractor shall also inform the Owner in writing at least sixty (60) Days in advance regarding the expiry /cancellation and/or change in any of such Documents and ensure revalidation, renewal etc., as may be necessary well in time.

37.3 The perils required to be covered under the Insurance shall include, but not be limited to fire and allied risks, miscellaneous accidents (Erection risks) Workman compensation risks, loss or damage in transit, theft, pilferage, riot and strikes and malicious damages, civil commotion, weather conditions, accidents of all kinds, etc. The Scope of such Insurance shall be adequate to cover the Replacement/ Reinstallation Cost of the Equipment for all risks up to and including delivery of Goods and other Costs till the Equipment is delivered at Site. The Insurance policies to be taken should be on replacement value basis and/or incorporating escalation Clause. Notwithstanding the extent of Insurance cover and the amount of Claim available from the underwriters, the Contractor shall be liable to make good the full replacement/ rectification value of all Equipment/Materials and to ensure their availability as per Project requirements.

37.4 All Costs on account of Insurance liabilities covered under the Contract will be on Contactor's account and will be included in Contract Price. However, the Owner may from time to time, during the pendency of the Contract, asks the Contractor in writing to limit the Insurance coverage, risks and in such a case, the Parties to the Contract will agree for a mutual settlement, for reduction in Contract Price to the extent of reduced Premium amount. The Contractor, while arranging the Insurance shall ensure to obtain all discounts on Premium that may be available for higher Value or for reason of financing arrangement of the Project.

38 Jurisdiction of court in case of dispute or differences arising on account of this tender

Any suit or application, arising out of any dispute or differences on account of this Tender, shall be filed in a competent court at Bangalore only and no other court or Forum or Tribunal shall, have any jurisdiction in the matter.

39 Penalty for offering illegal gratification to BMRCL employees

If the Contractor or any of his servants or agents, directly or indirectly gives promise or offers any bribe, gratuity, gift, loan, perquisite, reward or employment of BMRCL or in any other way directly or indirectly tries to influence the action of such an employee, in any way relating to his office or employment, the Contract shall be liable to be rescinded. In the event of the Contract being rescinded, the Security deposit of the Contract shall stand forfeited to BMRCL and further the work remaining unexecuted shall be carried out at the cost and risk of the Contractor. Such Contractor will be blacklisted and will not be permitted to participate in any future Tenders of BMRCL.

40 Breach of the part of BMRCL not to affect the contract

Breach or Non observance of any of the conditions or terms of the Contract by **BMRCL**, shall not entitle the Contractor to rescind the Contract, but he shall only be entitled to claim damages for loss incurred by him in accordance with law.

41 Law and language

The Contract shall be governed by the Acts and Laws of India, the rules, regulations and bye-laws of the concerned public bodies and authorities. Language of the Contract shall be English.

42 Corrupt or fraudulent practices

42.1 The Employer requires that the Tenderers / Suppliers / Contractors under this Contract, observe the highest standard of ethics during the procurement and execution of this Contract. In pursuance of this policy the Employer:

a) Defines, for the purpose of these provisions, the items set forth below as follows:

i. "Corrupt Practice" means the offering, giving, receiving or soliciting of anything of value to influence the action of a public official in the procurement process or in Contract execution; and

ii. "Fraudulent practice" means a misrepresentation of facts in order to influence a procurement process or the execution of a Contract to the detriment of the Employer, and includes collusive practice among Tenderers (prior to or after Tender submission) designed to establish Tender prices at artificial non-competitive levels and to deprive the Employer of the benefits of free and open competition.

b) Will reject a proposal for award of work if he determines that the Tenderer Recommended for award has engaged in corrupt or fraudulent practices in competing for the Contract in question.

c) Will declare a Tenderer ineligible, either indefinitely or for a stated period of time to be awarded a Contract/ Contracts if he at any time determines that the Tenderer has engaged in corrupt and fraudulent practices in competing for, or in executing, the Contract.

42.2 BMRCL and each Tenderer submitting the Proposal shall comply with these conditions of Tender and in their dealings with each other, discharge their duties and obligations on time and with integrity and behave equitably, honestly and transparently.

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SECTION - IV

SPECIAL CONDITIONS OF CONTRACT (SCC)

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SECTION-IV - SPECIAL CONDITIONS OF CONTRACT (SCC)

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SECTION – IV: SPECIAL CONDITIONS OF CONTRACT (SCC)

This Special Conditions of Contract (SCC) shall be read in conjunction with General Conditions of Contract (GCC), Section-III. Whenever there is a conflict, the provisions herein shall prevail over those in the GCC.

1 Brief description of the work

BMRCL has proposed for **"Supply, Installation, Testing and Commissioning of Commercial Power Point Metering Panels and arranging Power Supply from Metering Panels up to promotional KIOSKS in all Stations of Bangalore Metro Rail Project Phase-1 & Phase-2**" of Bangalore Metro Rail Project.

2 General

The Works are handled by the concerned Engineer-in-charge and will be assisted by authorized Officer for monitoring the proper execution of all the works and for measurement of works executed by the Contractor.

3 Brief scope of work

3.1 The work shall include, but not limited to Supply Installation, Testing and commissioning of LT Panels, cables & other electrical equipments etc.…

v. Erection of LT Metering panels as per specifications at various locations.

vi. Installation testing & commissioning of LT commercial metering panels during non-revenue period of Metro Rail operations (Only after 23.00 Hrs up to 4.00 Hrs at Night).

vii. Taking approval from BESCOM for arranging Sub Meter at each stations of BMRCL.

viii. The New system (work) is to be tested, commissioned and handed over to BMRCL under acknowledgement.

3.2 Not used.

3.3 The details of equipment to be supplied, transported, erected, assembled, tested & commissioned are indicated in BOQ / Pricing Document. The quantities indicated in the BOQ / Pricing Documents are only approximate and may increase or decrease and prices quoted by the Tenderer are deemed to be valid in spite of such variations subject to SCC Clause 10.

3.4 Any other items not specifically mentioned but which are essentially required for satisfactory performance & completeness of work, shall be deemed to be included in the scope of specifications and works and the same shall be executed / carried out by the Tenderer at no extra cost to BMRCL.

4 Standards:

4.1 Unless otherwise stated, all equipment / materials to be supplied and used under this Contract shall be new. All equipment / materials to be supplied / provided and work to be performed under the specifications shall in general conform to the latest issues including amendments of the B.I standards mentioned under respective equipment's heads.

4.2 For materials in respect of which no specifications have been indicated, such materials shall conform to the latest Indian Standard or in its absence, any other International Standard.

4.3 All materials used should be BMRCL / BESCOM approved makes and work should be executed as per BMRCL requirement.

5 General requirements

5.1 All equipment/materials shall be submitted for inspection by a duly authorized representative of the Engineer-in-charge. Inspection may be made at any stage of manufacture, dispatch or at site or at these places at the option of the Engineer-in charge and the equipment dispatched/about to be dispatched, if found unsatisfactory as to workmanship or quality, the same is liable to be rejected. The successful Tenderer / Contractor shall grant free access to the places of manufacture to the authorized representative of the Engineer-in-charge at all times when the works related to the manufacture are in progress.

5.2 Inspection and acceptance of any equipment / materials under the specifications by the Engineer-in-charge or his authorized representative shall not relieve the Contractor of his obligations of furnishing / supplying the equipment in accordance with the specifications.

5.3 All equipment / materials being supplied by the Contractor shall conform to the Type tests and shall be subject to Routine tests in accordance with relevant standards.

5.4 Type tests and routine tests on the equipment / materials being supplied, whenever specified shall be carried out in accordance with relevant standards, at the Contractor's cost. Copies of all routine test certificates of the following equipment shall be furnished to the Engineer.

5.5 Routine tests shall be witnessed at the manufacturer's premises in respect of the above materials by the representative of BMRCL.

5.6 The Contractor shall issue at least 7 days clear notice of routine tests to be conducted with details of time, place and venue to facilitate the representative of the Engineer to witness and certify such tests. In case any of the material is rejected during such test, the Contractor shall pay a penalty of Rs. 20,000.00/- (Rupees Twenty Thousand only) for each such failure when attended by the Engineer-in-Charge's representative.

5.7 For all other materials, not specifically mentioned above, the test certificate with regard to Type test and Routine Tests shall be furnished before the same are used for the works. The inspection and certification by the representative of the Engineer at the manufacturer's premises is not mandatory for such materials.

5.8 BMRCL reserves the right of getting any field test conducted on completely assembled equipment at site.

5.9 The Contractor is fully responsible for the Equipment / Material until the same is handed over to BMRCL in an operating condition after Commissioning. The Contractor is responsible for the proper maintenance of equipment / material as well as protection of the same against theft, elements of nature, damages etc., while in his custody as well as after erection until the same is taken over by BMRCL / concern department under due acknowledgment in writing.

5.10 The entire works to be executed under this Contract will be in stages & requires obtaining Line Clear Permits from the Engineer-in-charges representative or his subordinate before taking up the works by the Contractor from BMRCL / BESCOM. As such the Contractor shall take all mandatory safety precautions for executing the works & shall obtain Line Clear Permits with the Operational Authorities of the area prior to commencement of works on daily basis.

5.11 The work shall be carried out as per the direction of BMRCL Engineer in-charge. After the completion of Electrical work, the contractor shall check the functionality of BMRCL/BESCOM Electrical Installations during warranty period once in a fortnight and submit the report to Engineer in-charge/office of the Chief Engineer (U/S) BMRCL. The Tenderer should have an office / service center in Bangalore.

6 Acceptance of supplies

6.1 All or any articles / equipment / materials supplied against this Contract will be subject to the inspection and approval of BMRCL and/or any other officer deputed for the purpose.

7 Claims, Disputes, Conciliation and Arbitration

7.1 **Procedure for Claims**

If the Contractor intends to claim any additional payment under any clause of these Conditions or otherwise, the Contractor shall give notice to the Engineer as soon as possible and in any event within 30 days of the start of the event giving rise to the claim.

The Contractor shall keep such contemporary records as may be necessary to substantiate any claim, either on the Site or at any other location acceptable to the Engineer. Without admitting the Employer's liability, the Engineer shall, on receipt of such notice, inspect such records and may instruct the Contractor to keep further contemporary records. The Contractor shall permit the Engineer to inspect all such records, and shall (if instructed) submit copies to the Engineer.

Within 30 days of such notice, or such other time as may be agreed by the Engineer, the Contractor shall send to the Engineer an account, giving detailed particulars of the amount and basis of the claim. Where the event giving rise to the claim has a continuing effect, such amount shall be considered as interim. The Contractor shall then, at such intervals as the Engineer may reasonably require, send further interim accounts giving the accumulated amount of the claim and any further particulars. Where interim accounts are sent to the Engineer, the Contractor shall send a final account within 30 days of the end of the effects resulting from the event.

If the Contractor fails to comply with this Sub-Clause, he shall not be entitled to claim any additional payment.

7.2 **Amicable Settlement**

The Employer and the Contractor shall make every effort to resolve amicably through negotiation, any disagreement or dispute arising between them under or in connection with the Contract.

7.3 **No legal action till Dispute settlement procedure is Exhausted**

Any and all Disputes shall be settled in accordance with the provisions of Clause 7. No action at law concerning or arising out of any Dispute shall be commenced unless and until all applicable Dispute resolution procedures set out in Clause 7 shall have been finally exhausted in relation to that Dispute or any Dispute out of which that Dispute shall have arisen with which it may be / may have been connected.

7.4 **Notice of Disputes**

For the purpose of Sub-Clause 7.5, a Dispute shall be deemed to arise when one party serves on the other party a notice in writing (hereinafter called a "Notice of Dispute") stating the nature of the Dispute provided that no such notice shall be served later than 28 days after the date of issue of Performance Certificate by the Engineer.

7.5 **Two Stages for Dispute Resolution**

Disputes shall be settled through two stages

a) Conciliation procedures as established by “The Arbitration and Conciliation Act-1996” (as amended from time to time) and in accordance with this Clause. In the event this procedure fails to resolve the Dispute then;

b) Arbitration procedures undertaken as provided by “The Arbitration and Conciliation Act -1996” (as amended from time to time) and in accordance with this Clause.

7.6 **Conciliation**

Within 60 days of receipt of Notice of Dispute, either party shall refer the matter in dispute to conciliation.

Conciliation proceedings shall be initiated within 30 days of one party inviting the other in writing to Conciliation. Conciliation shall commence when the other party accepts in writing this invitation. If the invitation is not accepted, then Conciliation shall not take place. If the party initiating conciliation does not receive a reply within 30 days from the date on which he sends the invitation, he may elect to treat this as a rejection of the invitation to conciliate and inform the other party accordingly.

The Conciliation shall be undertaken by one Conciliator selected from a panel of Conciliators maintained by the Employer. The Conciliator shall assist the parties to reach an amicable settlement in an independent and impartial manner.

7.7 **Conciliation Procedure**

The Employer shall maintain a panel of Conciliators with requisite qualifications and professional experience who shall be from serving or retired Engineers of Government Departments, or of Public Sector Undertakings. Out of this panel, a list of three Conciliators shall be sent to the Contractor who shall choose one of them to act as Conciliator and conduct conciliation proceedings in accordance with “The Arbitration and Conciliation Act, 1996”, of India. The party serving notice of dispute on the other party shall also serve such notice on the Conciliator chosen as per this Clause. The Employer at the time of offering the panel of Conciliators to be appointed as Conciliator shall also supply the information with regard to the qualifications of the said Conciliators nominated in the panel along with their professional experience, phone nos. and addresses to the Contractor.

In the event of the Contractor not choosing the Conciliator from the panel furnished by the Employer, within a period of 30 days, the Employer is at liberty to choose and nominate a Conciliator from the same panel and communicate to the Contractor which will be final and binding on the Contractor.

The Employer and the Contractor shall in good faith co-operate with the Conciliator and, in particular, shall endeavor to comply with requests by the Conciliator to submit written materials, provide evidence and attend meetings. Each party may, on his own initiative or at the invitation of the Conciliator, submit to the Conciliator suggestions for the settlement of the dispute.

When it appears to the Conciliator that there exist elements of a settlement which may be acceptable to the parties, he shall formulate the terms of a possible settlement and submit them to the parties for their observations. After receiving the observations of the parties, the Conciliator may reformulate the terms of a possible settlement in the light of such observations.

If the Parties reach agreement on a settlement of the dispute, they may draw up and sign a written settlement agreement. If requested by the parties, the Conciliator may draw up, or assist the parties in drawing up, the settlement agreement.

When the parties sign the settlement agreement, it shall be final and binding on the parties and persons claiming under them respectively.

The Conciliator shall authenticate the settlement agreement and furnish a copy thereof to each of the parties.

As far as possible, the conciliation proceedings should be completed within 60 days of the receipt of notice by the Conciliator.

The parties shall not initiate, during the conciliation proceedings, any arbitral or judicial proceedings in respect of a dispute that is the subject matter of the conciliation proceedings.

7.8 **Termination of Conciliation Proceedings**

The conciliation proceedings shall be terminated:

a) by the signing of the settlement agreement by the parties on the date of agreement;

or

b) by written declaration of the conciliator, after consultation with the parties, to the effect further efforts at conciliation are no longer justified, on the date of declaration;

or

c) by a written declaration of the parties to the conciliator to the effect that the conciliation proceedings are terminated, on the date of declaration;

or

d) by a written declaration of a party to the other party and the conciliator, if appointed, to the effect that the conciliation proceedings are terminated, on the date of declaration.

Upon termination of the conciliation proceedings, the Conciliator shall fix the costs of the conciliation and give written notice thereof to the Parties. The costs shall be borne equally by the parties unless settlement agreement provides for a different apportionment. All other expenses incurred by a party shall be borne by that party.

7.9 **Arbitration**

If the efforts to resolve all or any of the disputes through conciliation fails, then such disputes or differences, whatsoever arising between the parties, arising out of or touching or relating to construction/ manufacture, measuring operation or

a) Only such dispute(s) or difference(s) in respect of which notice has been made under Clause 7.1 but could not be settled through Conciliation, together with counter claims or set

off, given by the Employer, shall be referred to arbitration. Other matter shall not be included in the reference.

b) The Arbitration proceedings shall be assumed to have commenced from the day, a written and valid demand for arbitration is received by Employer.

c) The dispute so referred to arbitration shall be settled in accordance with the Arbitration & Conciliation Act, 1996 as amended by the Arbitration & Conciliation (Amendment) Act, 2015 and any statutory modification or re-enactment thereof.

7.9.1 Further, it is agreed between the parties as under:

Number of Arbitrators: The arbitral tribunal shall consist of

i) Sole Arbitrator in cases where total value of all claims in question added together does not exceed Rs. 2.00 crores;

ii) Three (3) arbitrators in all other cases.

7.9.2 **Procedure for Appointment of Arbitrators:**

The arbitrators shall be appointed as per following procedure:

i) In case of Sole Arbitrator: Within 60 days from the day when a written and valid demand for arbitration is received by Employer, the Employer will forward a panel of 03 names to the Contractor. The Contractor shall have to choose one Arbitrator from the panel of three, to be appointed as Sole Arbitrator within 30 days of dispatch of the request by the Employer. In case the Contractor fails to choose one Arbitrator within 30 days of dispatch of the request of the Employer then Employer shall appoint any one Arbitrator from the said panel of 03 Arbitrator, as Sole Arbitrator.

ii) In case of 3 Arbitrators:

a) Within 60 days from the day when a written and valid demand for Arbitration is received by Employer, the Employer will forward a panel of 5 names to the Contractor. The Contractor will then give his consent for any one name out of the said panel, to be appointed as one of the Arbitrators within 30 days of dispatch of the request by the Employer.

b) Employer will decide the second Arbitrator. Employer shall appoint the second Arbitrator, in addition to the Arbitrator for whom consent was given by the Contractor, within the 30 days from the receipt of the communication regarding appointment of first Arbitrator from the Contractor. In case the Contractor fails to give his consent within 30 days of dispatch of the request of the Employer, then Employer shall nominate both the Arbitrators from the said panel.

c) The third Arbitrator shall be chosen by the two Arbitrators so appointed by the parties out of the panel of 05 Arbitrators provided to Contractor or from the larger panel of Arbitrators to be provided to them by Employer at the request of two appointed Arbitrators (if so desired by them) and who shall act as Presiding Arbitrator. In case of failure of two appointed Arbitrators to reach upon consensus within period of thirty days from the date of their appointment, then, upon the request of either or both parties, the Presiding Arbitrator shall be appointed by the Employer, from above Panel.

d) If one or more of the Arbitrators appointed as above refuses to act as Arbitrator, withdraws from his office as Arbitrator, or vacates his/their office/offices or is/are unable or unwilling to perform his functions as Arbitrator for any reason whatsoever or dies or in the opinion of the Employer fails to act without undue delay, the Employer shall appoint new Arbitrator/ Arbitrators to act in his/their place except in case of new Presiding Arbitrator who shall be chosen following the same procedure as mentioned in para (ii)(c) above. Such reconstituted Tribunal may, at its discretion, proceed with the reference from the stage at which it was left by the previous Arbitrator(s).

e) The Employer at the time of offering the panel of Arbitrator(s) to be appointed as Arbitrator shall also supply the information with regard to the qualification of the said Arbitrators nominated in the panel along with their professional experience, phone nos. and addresses to the Contractor.

7.9.3 **Qualification and Experience of Arbitrators (to be appointed as per sub clause 7.9.2 above):**

The Arbitrators to be appointed shall have minimum qualification and experience as under:

Arbitrator shall be;

A Working / Retired Officer (not below E-8 grade in a PSU with which BMRCL has no business relationship) of any discipline of Engineering or Accounts / Finance department, having experience in Contract Management of Construction Contracts; or A Retired Officer (retired not below the SAG level in Railways) of any Engineering Services of Indian Railways or Indian Railway Account Service, having experience in Contract Management of Construction Contracts; or a Retired Officer who should have retired more than 3 years previously from date of appointment as Arbitrator (retired not below E-8 grade in BMRCL or a PSU with which BMRCL has a business relationship) of any Engineering discipline or Accounts / Finance department, having experience in Contract Management of Construction Contracts or retired judge of any High Court or Supreme Court of India or reputed Chartered Accountant & should be a member of ICAI, New Delhi. No person other than the persons appointed as per above procedure and having above qualification and experience shall act as Arbitrator.

7.9.4 No new claim shall be added during proceedings by either party. However, a party may amend or supplement the original claim or defiance thereof during the course of arbitration proceedings subject to acceptance by tribunal having due regard to the delay in making it.

7.9.5 Neither party shall be limited in the proceedings before such arbitrator(s) to the evidence adduced or arguments put forth before the Engineer for the purpose of obtaining his decision. No decision given by the Engineer in accordance with the foregoing provisions shall disqualify him from being called as a witness and giving evidence before the arbitrator(s) on any matter, whatsoever relevant to dispute or difference referred to arbitrator/s. Neither party shall be limited in proceedings before such arbitrators to the evidence produced earlier or the arguments previously put forth during settlement through Conciliation proceedings.

7.9.6 It is agreed by both the Parties that in cases where Arbitral Tribunal consists of a Sole Arbitrator their disputes shall be resolved by the fast track procedure specified in sub-section (3) of 29B of the Arbitration and Conciliation (Amendment) Act, 2015 or as amended up to date.

7.9.7 If the contractor/s does/do not prefer his/their specific and final claims in writing, within a period of 90 days of receiving the intimation from the Employer/Engineer that the final bill is ready for signature of the Contractor(s), he/they will be deemed to have waived his/their claim(s) and the Employer shall be discharged and released of all liabilities under the contract in respect of these claims.

7.9.8 Arbitration proceedings shall be held at Bengaluru, India and the language of the arbitration proceedings and that of all documents and communications between the parties shall be in English.

7.9.9 The Arbitral Tribunal should record day to day proceeding. The proceedings shall normally be conducted on the basis of documents and written statements. All arbitration awards shall be in writing and shall state item wise, the sums awarded or claims rejected and detailed reasons upon which it is based. A model time schedule for conduct of Arbitration proceedings in a period of 180 days/ 365 days will be made available to Arbitral Tribunal for their guidance. Both the parties should endeavor to adhere to time schedule for early finalization of award.

7.9.10 The award of the sole Arbitrator or the award by majority of three Arbitrators as the case may be shall be binding on all parties. Any ruling on award shall be made by a majority of members of Tribunal. In the absence of such a majority, the views of Presiding Arbitrator shall prevail.

7.9.11 A party may apply for correction of any computational errors, any typographical or clerical errors or any other mathematical error of similar nature occurring in the award of a tribunal and interpretation of specific point of award to tribunal within 60 days of the receipt of award.

7.9.12 A party may apply to tribunal within 60 days of receipt of award to make an additional award as to claims presented in the arbitral proceedings but omitted from the arbitral award.

7.10 **Reasoned Award**

The Arbitrator(s) shall always give item-wise and reasoned award(s) irrespective of the value of claim(s) in the dispute in all cases.

7.11 **Interest on Arbitration Award**

Where the arbitral award is for the payment of money, no interest shall be payable on whole or any part of the money for any period, till the date on which the award is made.

7.12 **Cost of Arbitration**

The cost of arbitration shall be borne by the respective Parties. The cost shall, inter-alia, include the fees of the Arbitrator(s) as per rates fixed by the Employer from time to time.

7.13 **Suspension of Work on Account of Arbitration**

The reference to Conciliation / Arbitration shall proceed not withstanding that the Works shall not then be or be alleged to be complete, provided always that the obligations of the Employer, Engineer and the Contractor shall not be altered by reasons of arbitration being conducted during the progress of the Works. Neither party shall be entitled to suspend the work or part of the work to which the dispute relates on account of arbitration and payments to the Contractor shall continue to be made in terms of the Contract.

8 Indemnity bond:

8.1 It will be the responsibility of the Contractor to make/take delivery, unload and store all the Equipment's / Material. The Contractor shall execute an Indemnity Bond as per the proforma enclosed in Annexure D of Section VI in favour of BMRCL against loss, damage and any risks involved for the full value of these materials. This Indemnity Bond shall be furnished by the Contractor before commencement of the supplies and shall be valid till the scheduled date of Testing & Commissioning and handing over of the work to the Engineer.

8.2 For the Equipment's/Materials to be provided by the owner, the Contractor shall adopt the following procedure to take delivery of Equipment's/materials.

a) The dispatch title documents will be handed over to the Contractor only after obtaining a Test Report in respect of plant, equipment and materials as per prescribed proforma.
b) The Indemnity Bond as per proforma, enclosed as Annexure-D in Section VI shall be executed by the Contractor.
c) BMRCL will also issue a separate authorization letter to the Contractor to enable him to take physical delivery of Materials/Plant/Equipment's (if required).

9 Storage cum erection insurance:

9.1 All the Equipment and Materials being supplied by the Contractor for the Package shall be kept completely insured by the Contractor at his cost from the time of dispatch from their works, up to the completion of erection, Testing and Commissioning at site and taking over of the project by the Owner in accordance with the Contract.

9.2 Further all the Equipment and Materials being supplied by the Owner for the erection as per Technical Specification shall be kept insured by the Contractor against any loss. damage, pilferage, theft, fire etc. from the time of unloading up to the time of taking over by the Owner including handling, transportation, storage, Erection, Testing Commissioning etc. The premium to be paid to the Insurance Company by the Contractor for such Insurance shall be included in the total Tender price.

9.3 It will be the responsibility of the Contractor to lodge, pursue and settle claims with the Insurance Company in case of any loss. Pilferage, theft, or fire and the Owner shall be kept informed about it. The Contractor shall be responsible to replace any such equipment / material during execution of the Contract irrespective of the time or amount of receipt of insurance claim. Any loss in this regard shall be borne by the Contractor

10 Quantity variation

10.1 The quantities indicated in Schedule of prices are only approximate & may increase or decrease during the execution of the Contract. BMRCL reserves the right to increase or decrease the quantities of items under the Contract but without any change in unit prices or other terms & conditions. Such increase or decrease may vary up to **100%** of the Contracted quantity of individual items subject to a maximum of **+ /- 25% (Twenty Five Percent)** of the original Contract value. However, the prices quoted by the Tenderer and other terms and conditions shall be valid in spite of such variations in quantities.

10.2 For any additional item/s not found in the BOQ, if it is required to be executed for completion of the work under this Contract, the rate shall be as per BESCOM/KPWD Schedule of Rates plus or minus or at par Tender premium which BMRCL has accepted. If the item required is not found in any of the Schedule of Rates, then the mutually agreed market rate shall be adopted but no Tender premium would be applicable.

11 Priority of documents

The documents forming the Contract are to be taken as mutually explanatory of one another. If there is an ambiguity or discrepancy in the documents, the Engineer shall issue any necessary clarification or instruction to the Contractor, and the priority of the documents shall be as follows:

(1) Contract Agreement
(2) Letter of Acceptance, notice to proceed with works
(3) Priced Bill of quantities (as accepted by the Employer)
(4) Technical Specifications
(5) Drawings
(6) Special Conditions of Contract
(7) General Conditions of Contract
(8) Contractor's Proposal and
(9) Any other document listed as forming part of the Contract.

12 Payment in stages

Compensation for items shall include for all costs incurred in procurement/ manufacture, testing, inspection, shipping, hauling, off-loading, storing at site in Bangalore, installation, testing and commissioning including integrated testing and commissioning. Prices so assigned in the BOQ, for supply and installation of items of materials, plant and equipment shall be full compensation for supply and installation of items of materials, plant and equipment in accordance with drawings and specifications, Payment towards supply and installation will be made after receipt of items of materials, plant and equipment to the Contractor's depot (in the land provided by BMRCL) in Bangalore and storing them in a place and manner approved by the Engineer and submission of the following documents:

i. Certificate of type tests
ii. Certificate of Factory Acceptance Testes;
iii. Certificate of inspection by the Engineer
iv. Proof of Insurance
v. Technical literature and equipment manual;
vi. Packing list; and
vii. Joint record of measurement in approved format, on the following basis;

a) 70% payment on supply of materials, 20% of payment for installation and balance 10% of payment on completion of integrated testing, commissioning, submission of all test reports, other documentation including as-built drawings, guarantee warranty certificates, manuals etc. for

i. LV Panels and
ii. Distribution Board

b) 60% payment against supply of material, 30% payment against installation and balance 10% price so assigned for testing and commissioning of items of materials, plant and equipment is tested and commissioned successfully including integrated testing and commissioning and submission of all test results, other documentation including as-built drawings, manuals, etc., as described in the specifications, have been approved by the Engineer.

i. Earthing System
ii. Cable Trays & Steel Works
iii. LV Cables and
iv. Conduit, Wiring & accessories.

c) Payment will be made in RA bills as part payments duly certified by BMRCL for receipt of materials in good condition and correct quantity.

d) Original invoice voucher to be verified by BMRCL and copy to be enclosed with RA bills.

e) Security & Safety of material brought to the site will be sole responsibility of contractor till the completion of corresponding work and handing over to BMRCL.

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SECTION – V

FORM OF TENDER

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FORM OF TENDER

(Refer ITT clause 36.6)

Ref No.: Date. dd.mm.yyyy

From:

To:

The Managing Director
BANGALORE METRO RAIL CORPORATION LIMITED,
III Floor, BMTC Complex, K.H. Road,
Shanthinagar,
Bangalore-560 027.

Sir,

1. Having examined and understood the Instructions to Tenderer, General Conditions of the Contract, Special Conditions of Contract, Technical Specifications and any other documents forming part of the Tender document issued under Tender notification no. …….. dated …….. including any addendum /amendments, the receipt of which is hereby duly acknowledged, I/We the undersigned, hereby submit the fully completed Tender proposal, which includes the following.

    a) Qualification cum Technical Package

    b) Financial Package

    for the said work online through Karnataka Public Procurement Portal (e-Procurement portal).

2. I/We hereby agree to execute the Contract in conformity with the Specifications & Conditions of Contract enumerated in the Tender Documents, for the sum stated & quoted in the Tender or such other sums as may be ascertained in accordance with the Financial Proposal attached herewith and submitted through e-Procurement portal.
3. We undertake that, in competing for (and, if the award is made to us, in executing) the above Contract, we will strictly observe the laws against fraud and corruption in force in India namely “Prevention of Corruption Act 1988”.
4. We hereby confirm that this Tender complies with the Tender validity and Tender Security / EMD required by the Tender documents.
5. I/We undertake, if the Tender is accepted, to execute the Contract Agreement with in the stipulated time of 21 (twenty-one) working days.
6. In case of acceptance of the Tender, I/We also undertake to carry out supply, installation, testing and commissioning of the Works and complete the same and commission within the stipulated time as specified in the Tender documents and further will obtain and furnish Performance Security for the amount/s specified in ‘Appendix to Form of Tender’ (Section-V) for the due performance of Contract.
7. I/We note that the prices offered are firm throughout the period of Contract including extended period if any as per the Commercial Terms and Conditions.
8. I/We agree to keep this Tender valid for a period specified in ‘Appendix to Form of Tender’ (Section-V) & it shall remain binding upon us & may be accepted at any time before expiration of that period.

9. Since time is the essence of Contract, I/We undertake that all care is taken not to overrun the time specified and agree to pay penalty (one percent of the Original Contract Price / week subject to a maximum of ten percent) of the value of work which is not completed for the delay beyond the period specified for completion of the work.
10. I/We have enclosed **BG for Rs**._____ide **BG No**._____**dated**_____ **of** _____Bank drawn in favour of the Managing Director, BMRCL, Bangalore-560 027 payable at a designated Bank in Bangalore being the requisite EMD as per Tender. Karanataka e-Procurement Portal.
11. Until a Contract is prepared & executed this Tender together with written acceptance by BMRCL by notification of Award shall constitute a binding Contract.
12. I/We understand that BMRCL is not bound to accept the lowest or any Tender it may receive.

Dated this …….. day of ……., 2023.

(Signature)

Name in Block Letter

(In the capacity of)

(DESIGNATION)

Duly authorized to sign Tender for and on behalf of (NAME OF FIRM)

Witness:

Address: **Signature**

APPENDIX TO FORM OF TENDER

SALIENT FEATURES OF CONTRACT

No.	Reference Contract Clauses	Description
1.	Amount of Performance Security (GCC - Clause 12)	**10% (Ten percent) of the Contract Price** in which the Contract price is payable. In the event of variations during the execution of the Contract which result in payments to the Contractor over and above the original Contract price, the Performance Security shall be suitably adjusted.
2.	Date for commencement of the Works (ITT - Clause 31)	Date of issue of Letter of Award (LOA).
3.	Time for Completion (GCC clause 27)	The works shall be completed in all respects within **9 months** from the date of commencement including monsoon period.
4.	Penalty for delay in execution of work (GCC-Clause 29)	i. The penalty shall be 1 % of the original Contract price per week of delay or part thereof subject to a maximum of 10% on the portion of work which is not completed for beneficial use ii. Penalties levied for the following: a) Non-fulfillment of program of works within the stipulated period. b) The number of days allowed beyond the stipulated period for completing the work and c) Extra cost that might be incurred by BMRCL for getting the balance work completed through any other agency as it deems fit under the circumstances will be deducted from money due to him by BMRCL for work done under the Contract or otherwise.
5.	Guarantee of Works / Defects Liability Period (GCC-Clause 35)	For a period of **12 months** from the date of issue of the Completion Certificate / Taking Over Certificate, the Contractor shall be liable for the works or any portion thereof found to be defective for causes arising from faulty materials or workmanship or other causes for which in the judgment of BMRCL/BESCOM, the Contractor is responsible.
6.	Period in which all insurances have to be effected (GCC Sub-Clause 37 and SCC Clause 9)	The Contractor shall maintain adequate Insurance Coverage at all time during the period of Contract and the premium to be paid to the Insurance Company by the Contractor for such Insurance shall be included in the total Tender price.
7.	Validity of Tender (ITT Clause 17)	**120 days** from the last date for Tender submission.
8.	Amount and validity of Tender Security / EMD (ITT Clause 16)	• **INR 8,53,298/-** (Rupees Eight Lakhs Fifty Three Thousand Two Hundred and Ninety Eight Only). • 45 days beyond the validity date of the Tender i.e. **165 days from the last date for Tender submission as per e-Procurement Portal**

No.	Reference Contract Clauses	Description
9.	Date & time and place of Tender Submission and Tender opening (ITT clause 13 and ITT clause 20)	• **Date and Time** As per Date and Time specified in Karnataka Public Procurement Portal**.** • **Place of submission of Original documents** as listed under ITT clause 13.2: The Chief Engineer(U/S) BMRCL, BMTC Complex, III Floor, Shanthinagar, Bangalore 560027. • **Tender proposal to be submitted online in Karnataka Public Procurement Portal.**
10.	Contractor's Name and Address	---------- ---------- ---------- *(Tenderers to complete)* ---------- ---------- ----------
11.	Employer's Name and Address	Bangalore Metro Rail Corporation Limited III Floor, BMTC Complex, K.H.Road, Shanthinagar, Bangalore-560 027, Karnataka State, India
12.	Last date up to which clarification on Tender conditions can be sought	As per Date and Time specified in Karnataka Public Procurement Portal**.**

SECTION - VI

PROFORMA

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Annexure – A

FORM OF AGREEMENT

(as per 33.0 of ITT)

CONTRACT No. BMRCL…….....

This **Contract Agreement** (hereinafter called the **"Contract"**) is made at Bangalore on the .....day of ".....*Month & Year*....." by and between:

BANGALORE METRO RAIL CORPORATION LIMITED, a Company incorporated under Companies Act 1956, represented herein by ……., authorized to sign and bind the Company, with its office located at III Floor, BMTC Complex, K.H. Road, Shanthinagar, Bengaluru 560 027, Karnataka State, India hereinafter referred to as the **"BMRCL"** or the **"EMPLOYER"**, as the case may be, which expression shall unless excluded by or repugnant to the context or meaning thereof be deemed to include its successors and assigns, of the one part,

and

M/s. ".....(*Name of Contractor*) ....." a proprietorship concern having their office/principal place of business at "……*Address*……" represented by its ……. herein referred to as the **"CONTRACTOR"** which expression shall unless excluded by or repugnant to the context or meaning thereof be deemed to include its successors to business, legal heir and assigns, on the other part,

WHEREAS the Contractor has offered a Tender for the work of "……. *(name of works)* ....." and for this purpose agrees to undertake performance of the work under the Terms and Conditions set forth in this Contract.

AND WHEREAS BMRCL has accepted the Tender submitted by the Contractor for execution of the aforesaid Work and agrees to hire the 'Contractor' and the 'Contractor' agrees to be hired to implement the work of "…… *(name of works)* ....." vide CONTRACT No. BMRCL……. under the Terms and conditions specified in this Contract Agreement and the other Contract Documents.

Now THEREFORE the parties hereby agree as follows:

Clause 1: Words and Expression

In this Contract, all the words and expressions shall have the same meanings as are respectively assigned to them in the Conditions of Contract hereinafter referred to.

Clause 2: The Contract Documents

The following shall be deemed to form and be read and construed as a part of this Contract Agreement:

a) Letter of Award No. …… dated .....
b) Instructions to Tenderers / Bidders
c) General Conditions of Contract.
d) Special Conditions of Contract
e) Bid Forms / Tender Forms
f) Technical Specifications including scope of Work.
g) Priced Bill of quantities.

h) Contractor's Technical and Financial proposal date.....
i) Drawings.
j) All correspondence between the Tenderer / Bidder and BMRCL from the date of issue of NIT and the date of issue of LOA.
k) Performance Security in the form of Bank Guarantee issued by Bank……(Write name of the Bank) vide B.G. No…….. dated…… amounting to Rs…… (in words) ……. valid up to …… and its authenticity as confirmed by the issuing bank vide their SFMS No……...dated…….
l) Any other document forming part of this Contract.

All of the foregoing documents, together with this Contract Agreement, are referred to herein as the Contract. Also incorporated into the Contract and made part hereof, are all codes, standard specifications, and similar requirements that are referred to therein.

Clause 3: Obligations of the Contractor

The Contractor agrees, subject to the terms and conditions of the Contract, to perform efficiently and faithfully all of the works of "……*Name of the work*……..." which includes "……*brief description of work*…...." required for or incidental to the successful completion of the Works and in carrying out all duties and obligations imposed by, the Contract.

Clause 4: Obligation of the Employer

In consideration thereof, the 'Employer' agrees, subject to the terms and conditions of the Contract, to pay the Contractor the amount specified and at the rates and terms and in the manner set forth in the Contract.

Clause 5: Contract Price and Completion Time: The Contract price shall be inclusive of all taxes, duties and cess including taxes deducted at source, insurance and exclusive of CGST and SGST. BMRCL shall pay the CGST and SGST as applicable as per law as per clause ..26..... of General Conditions of Contract and completion time for executing the works under the Contract are as specified below:

1.	Amount Specified in the Tender	
2.	Accepted percentage premium of the Tender (Above / Below / At par)	
3.	Accepted Contract Price	
4.	Date of Commencement of work	
5.	Completion period	

Clause 6: Integration

The 'Employer' and the 'Contractor' agree that this Contract Agreement, together with other Contract Documents referred to in clause 2 above, expresses all of the agreements, understandings, promises and covenants of the parties, and integrates, combines and supersedes all prior and contemporaneous negotiations, understandings and agreements, whether written or oral and no modification or alteration of the Contract Documents shall be valid or binding on either party, unless expressed in writing and executed with the same formality as this Contract Agreement, except as may otherwise be specifically provided in the Contract Documents. This contract agreement shall prevail in case of any inconsistencies contained in the contract documents.

Clause 7: Governing Law

This Contract is construed and enforceable under the applicable laws of the Republic of India.

Clause 8: Jurisdiction

Where recourse to a Court of law is to be made in respect of any matter, the Court at Bangalore shall have the exclusive jurisdiction to try all disputes between Parties, under this contract agreement.

Clause 9: Language

This Contract Agreement and the other Contract Documents are made in the English language.

Clause 10: Notices

All Notices called by the Terms of the Contract shall be in writing in English Language and shall be delivered by hand or by registered Post with acknowledgement due. All notices shall be deemed to be duly made by the party to whom it is addressed at the following address or such other addresses as such party may subsequently notify the other.

To Employer:

Chief Engineer (U/S)

".....Address ....."

To Contractor:

M/s. …….

……

……..,

IN WITNESS WHEREOF, the parties hereto have caused this Contract to be signed in their respective name by the authorized signatories as of the day and year first above written

BMRCL/The Employer **Bangalore Metro Rail** **Corporation Limited** **(EMPLOYER)**	**……..,** **(CONTRACTOR)**
(……)	( ) M/s …….,
WITNESS	**WITNESS**
(……..)	( ) M/s ……..

Note:-

The Form of Agreement is tentative and may be modified as considered necessary at the time of finalization/signing of the contract.

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Annexure – B

BANK GUARANTEE FOR TENDER SECURITY/EARNEST MONEY DEPOSIT OF TENDER

(Refer ITT clause 16)

To
Bangalore Metro Rail Corporation Limited (BMRCL)
3rd, floor BMTC Complex,
K.H. Road, Shanthinagar
Bangalore- 560027.
Karnataka, India.

1. **WHEREAS**_____ (Name and Address of the Tenderer hereinafter called the "Tenderer") has undertaken for submission of Tender in pursuance of Contract No._____ (description of the Contract work of Bangalore Metro Rail Project to be specified, hereinafter called "the Tender").

2. AND WHEREAS it has been stipulated in the concerned Tender notification issued by Bangalore metro Rail Corporation Limited (BMRCL) which expression shall unless repugnant to the context or the meaning thereof, include its successors, administrators, executors and assignees, herein after called the Employer) to the Tenderer that the Tenderer shall furnish to EMPLOYER(BMRCL) with a Bank Guarantee as per the conditions of the Tender, from an Indian scheduled Bank (excluding Cooperative Bank) or from a schedule Foreign Bank as defined in Section 2(e) of RBI Act 1934 r/w second schedule for, the sum specified herein below as Tender security for compliance of the obligation and performance, in accordance with the concerned Tender conditions.

3. AND WHEREAS we_____ (the name and full address of the Bank including Email address) having registered office at_____ (hereinafter referred to as the issuing Bank) which expression shall unless repugnant to the context or the meaning thereof, include its successors, administrators, executors and assignees, do hereby agree to give the Contractor such a Bank Guarantee, drawn and payable at Bangalore_____ through Bangalore _____Branch.

4. NOW therefore, we hereby affirm that we are the guarantor and responsible to EMPLOYER(BMRCL) and their successor, on behalf of the Tenderer up to a total sum of Indian Rupees of Rs. _____ (amount of Guarantee to be specified in figure and words), and we hereby further unconditionally, irrevocably and without demur undertake to immediately pay you, upon your first written demand and without cavil, or arguments any sum or sums within the limits of Indian Rupee_____(Bank guarantee amount to be specified) as aforesaid without requiring you to prove or to show grounds or reasons for your demand, by depositing/crediting to the Current A/c. of EMPLOYER (BMRCL), the sums specified therein.

5. This Bank Guarantee is encashable or extendable at our designated Branch in Bengaluru (Bangalore) Karnataka, India, as mentioned below:
   Name of the Bank, Branch and contact details
   Address
   Telephone no: & Fax No:
   E-mail Address
   Branch manager name& mobile No:
   Bank Zonal Office Address, Telephone No:……. Fax Number: ……..
   E-mail Address

6. "This Bank Guarantee shall be encashed unless renewed by the Contractor at the request of the Employer, before the due date".

7. The Bank is liable to pay the EMPLOYER (BMRCL), any amount up to and inclusive of the aforementioned full amount upon written order from the EMPLOYER (BMRCL). The Bank will pay the money required by the EMPLOYER (BMRCL) immediately on demand without delay without

reference to the Tenderer and without the necessity of a previous notice or of judicial or administrative procedures and without it being necessary to prove to the Bank the liability or damages resulting from any defects or shortcomings or debts of the Tenderer.

8. BMRCL shall have full rights to encash this Bank Guarantee at any time during the guarantee period and the Tenderer shall have no right or claim whatsoever in the matter of encashment of the Bank Guarantee amount by the Employer (BMRCL). The Bank will have their responsibility in terms of the guarantee and obligation, to make immediate payment to the EMPLOYER (BMRCL), without the consent of the Tenderer and without referring the matter to the Tenderer.
9. Courts at Bangalore, Karnataka, India shall have exclusive jurisdiction to adjudicate disputes arising out of encashment of the Guarantee, and we, the said Bank, undertake not to revoke this Guarantee during its currency, except with the previous consent of the Employer in writing and agree that any change in the constitution of the Bank shall not discharge our liability hereunder.
10. This Bank Guarantee will not be discharged due to the change in the constitution of the Tenderer or change in the constitution of the issuing bank
11. This guarantee is executed and issued by Shri _____who is/are authorized by the Bank for issuing the guarantee in its behalf and his ID No. and Email address being----------
12. The Banks liability under this Guarantee shall not exceed the amount of INR_____ (to be specified in words and figures_____).
13. This guarantee shall be valid for (period to be specified) till ____ (Period to be mentioned).
14. The pendency of any dispute or arbitration or other proceedings shall not affect this guarantee in any manner.
15. It is hereby agreed that the liability of the Bank under this guarantee shall cease on the first occurrence of either of the following events:

a) Payment by the Bank of the Guaranteed sum in full to the Employer/BMRCL

OR

b) Receipt of written communication from the Employer/BMRCL, to the issuing Bank, along with the Original Bank Guarantees discharging the Bank of its liability covered by this Bank Guarantee.

SIGNATURE AND SEAL OF THE GUARANTOR	SIGNATURE AND SEAL OF THE GUARANTOR
NAME OF THE BANK_____	NAME OF THE BANK_____
ADDRESS_____	ADDRESS_____
DATE:	DATE:

Notes:

1. *The stamp papers of appropriate value shall be purchased in the name of the Bank, who issue the Bank Guarantee.*
2. *The Bank Guarantee shall be from an Indian Scheduled bank (excluding Cooperative Banks) or from a schedule Foreign Bank as defined in Section 2(e) of RBI Act 1934 read with Second Schedule, preferably drawn on and payable/extendable at a designated branch at Bangalore only.*
3. *The Scheduled Bank issuing the Bank Guarantee should preferably be on "Structure Financial Messaging System (SFMS)" platform. A separate advice of the BG shall preferably be sent by the issuing bank to the Employer's Bank through SFMS.*

   The issuing Bank shall send the SFMS to:
   Name: BANGALORE METRO RAIL CORPORATION LTD.,
   Name of the Bank: BANK OF INDIA
   Branch: CANTONMENT BRANCH, BENGALURU.
   Account No: 840420110000760
   RTGS/IFSC: BKID0008404

Annexure - C

BANK GUARANTEE FOR PERFORMANCE OF CONTRACT

(Refer ITT clause 3)

To
BANGALORE METRO RAIL CORPORATION LIMITED (BMRCL)
III FLOOR BMTC COMPLEX,
K.H. ROAD, SHANTHINAGAR
BANGALORE- 560027.
KARNATAKA, INDIA.

1. **WHEREAS**_____(Name and Address of the Contractor hereinafter called the "Contractor") has undertaken for due performance of Contract, in pursuance of Contract No._____(description of the Contract work of Bangalore Metro Rail Project to be specified) (hereinafter called "the Contract").

2. **AND WHEREAS** it has been stipulated in the concerned Contract awarded by Bangalore Metro Rail Corporation Limited (BMRCL) hereinafter called the "Employer" which expression shall unless repugnant to the context or the meaning thereof, include its successors, administrators, executors and assignees, to the Contractor that the Contractor shall furnish to EMPLOYER(BMRCL) with a Bank Guarantee for due performance of Contract from an Indian scheduled Bank (excluding Cooperative Bank) or from a schedule Foreign Bank as defined in Section 2(e) of RBI Act 1934 r/w second schedule for, the sum specified herein below as security for compliance of the obligation and performance of the Contractor, in accordance with the concerned Contract.

3. **AND WHEREAS** we_____ (the name and full address of the Bank including Email address) having registered office at_____ (hereinafter referred to as the issuing Bank) which expression shall unless repugnant to the context or the meaning thereof, include its successors, administrators, executors and assignees, do hereby agree to give the EMPLOYER (BMRCL) on behalf of the Contractor such a Bank Guarantee, drawn and payable at Bangalore_____ through our Bangalore _____Branch.

4. **NOW** therefore, we hereby affirm that we are the guarantor and responsible to EMPLOYER (BMRCL) and their successors, on behalf of the Contractor upto a total sum of _____ (amount of Guarantee to be specified in figure and words). Further, we hereby unconditionally, irrevocably and without demur undertake to immediately pay you, upon your first written demand and without cavil, or arguments any sum or sums within the limits of the sum specified in this Bank Guarantee as aforesaid without you being required to prove or to show grounds or reasons for your demand, by depositing/crediting to the Current A/c. of EMPLOYER (BMRCL), the sums specified.

5. This Bank Guarantee is encashable or extendable at our designated Branch in Bengaluru (Bangalore) Karnataka, India, as mentioned below:

   Name of the Bank, Branch and contact details
   Address
   Telephone no: & Fax No:
   E-mail Address
   Branch manager name & mobile No:
   Bank Zonal Office Address, Telephone No: Fax Number,
   E-mail Address

6. "This Bank Guarantee shall be encashed unless renewed by the Contractor at the request of the Employer, before the due date".

7. BMRCL shall have rights to encash this Bank Guarantee at any time during the guarantee period and the Contractor shall have no right or claim whatsoever in the matter of encashment of the Bank Guarantee amount by the Employer. The Bank will have their responsibility in terms of the guarantee and obligation, to make immediate payment to the EMPLOYER (BMRCL), without the consent of the Contractor and without referring the matter to the Contractor.

8. The Bank shall be liable to pay the EMPLOYER (BMRCL), any amount upto and inclusive of the aforementioned full amount upon written order from the EMPLOYER (BMRCL) to indemnify BMRCL for any liability of damage resulting from any defects and/or shortcomings of the Contractor and/or the debts the Contractor may have incurred, to EMPLOYER(BMRCL) and/or any parties involved in the Works under the Contract mentioned above, whether these defects and/or shortcomings and/or debts are actual and/or estimated and/or expected. The Bank will deliver the money required by the EMPLOYER (BMRCL) immediately on demand without delay without reference to the Contractor and without the necessity of a previous notice or of judicial or administrative procedures and without it being necessary to prove to the Bank the liability or damages resulting from any defects or shortcomings or debts of the Contractor.
9. Courts at Bangalore, Karnataka, India shall have exclusive jurisdiction for adjudicating the disputes arising out of encashment of the Guarantee, and we, the said Bank under take not to revoke this Guarantee during its currency, except with the previous consent of the Employer in writing and agree that any change in the constitution of the Bank shall not discharge our liability hereunder.
10. This Bank Guarantee will not be discharged due to the change in the constitution of the Contractor or change in the constitution of the issuing bank.
11. This Deed of guarantee is signed and executed by Shri _____who is/are authorized by the Bank for issuing the guarantee in its behalf and his ID No. and Email address being _____.
12. The Bank's liability under this Guarantee shall not exceed the amount of INR _____ (to be specified in words and figures_____).
13. This guarantee shall be valid for (period to be specified) till _____ (Period to be mentioned).
14. The pendency of any dispute or arbitration or other proceedings shall not affect this guarantee in any manner.
15. It is hereby agreed that the liability of the Bank under this guarantee shall cease on the happening of any of the following events:
    a) Payment by the Bank of the Guaranteed sum in full to the Employer/ BMRCL

    or

    b) Issue of written communication by the Employer/BMRCL to the issuing Bank, along with the Original Bank Guarantees discharging the Bank of its liability covered by this Bank Guarantee.

Date SIGNATURE AND SEAL OF THE GUARANTOR

NAME OF THE BANK_____

ADDRESS_____

Notes:

1. *The stamp papers of appropriate value shall be purchased in the name of the Bank, who issue the Bank Guarantee.*
2. *The Bank Guarantee shall be from an Indian Scheduled bank (excluding Cooperative Banks) or from a schedule Foreign Bank as defined in Section 2(e) of RBI Act 1934 read with Second Schedule, drawn on and payable/ Extendable at a designated branch at Bangalore only.*
3. *The Scheduled Bank issuing the Bank Guarantee should preferably be on "Structure Financial Messaging System (SFMS)" platform. A separate advice of the BG shall preferably be sent by the issuing bank to the Employer's Bank through SFMS.*

   The issuing Bank shall send the SFMS to:

   Name: BANGALORE METRO RAIL CORPORATION LTD.,
   Name of the Bank: BANK OF INDIA
   Branch: CANTONMENT BRANCH, BENGALURU.
   Account No: 840420110000760
   RTGS/IFSC: BKID0008404

Annexure – D

INDEMNITY BOND

[Refer SCC clause 8.2(b)]

THIS AGREEMENT is made on ……by and between BANGALORE METRO RAIL CORPORATION LIMITED, a company registered under the companies Act, 1956 and having its registered office at IIIrd Floor, BMTC COMPLEX, K.H ROAD, SHANTHINAGAR, BANGALORE-560 027 herein after referred to as the "OWNER" (which expression shall, unless excluded by or repugnant to the context or the meaning thereof, be deemed to include its successors and assigns) on the ONE PART

AND

M/s. …… having its registered office/principal place of business at …… (hereinafter referred to as the "CONTRACTOR"), which expression shall unless excluded by or repugnant to the context or the meaning thereof, be deemed to include its successors and assigns on the OTHER PART.

WITNESSETH THAT

WHEREAS, the Contractor submitted Tender for execution of the work of ……

…….. In accordance with the finally accepted Tender documents with necessary additions/alterations if any

AND

WHEREAS the Employer has accepted the said Tender submitted by the Contractor wherein the Contractor has agreed to execute the aforesaid work

AND

WHEREAS the Contractor has agreed to execute the work on the terms and conditions stated in the Contract Agreement executed on ……. Clause 25.0 of General Condition of Contact of the said Contract Agreement provides for payment by Employer to the Contractor for execution of the work subject to submission of Indemnity Bond & Insurance.

Now, therefore, in consideration of the foregoing promises and mutual convenience herein contained, the Contractor hereby agrees as follows:

1. The materials brought to the site for executing the Contract, for which payment is made by the Employer to the Contractor shall stand hypothecated to the Employer without any further act.
2. The Contractor do hereby agree that it shall not hypothecate, alienate or create any encumbrance on the materials for which payment is released by the Employer.
3. The Contractor shall confirm and furnish a certificate that materials have been physically brought to and have not been incorporated in the work.
4. It shall be the responsibility of the Contractor to ensure that the materials are stored satisfactorily and are designated in stock. The Employer reserves the right to carry out physical verification by giving notice to the Contractor and the Contractor is bound to give all necessary details including records and invoices for carrying out verification. In the event of any discrepancy noticed by the

Employer, the Contractor do hereby undertakes to make good the losses within ……. days or as notified by the Employer.

5. The Contractor shall ensure that the quantities of stores tally with the quantities of the Contract items for which payment is released by the Employer.
6. The Contractor shall affirm that no materials advance has been paid earlier against the same materials.
7. The Contractor shall ensure that materials conform to the specifications and are of tested quality.
8. The Contractor shall not be entitled to draw / avail loan against the materials for which payment is released by the employer from Bank.
9. The Contractor shall also take Insurance Cover equivalent to the value of the materials for which payment is released by the employer.
10. The Contractor shall provide access to check / cross check the quality / quantity of materials prior to and after the payment.
11. The courts of Bangalore only shall have jurisdiction to deal with and decide any legal matter or dispute whatsoever arising out of this agreement.
12. All the parts of this Contract have been read and fully understood by us.

In witness whereof, the said Company and the Contractor have hereto set their respective hands, on the day, month and year first above written in the presence of the following witnesses:

Name of the Contractor :
Designation of authorized signatory :

Seal of the Contractor :

Witness:

1.……..…

2……..

Annexure - E

TENDERER'S DECLARATION

I/We have inspected the site of works and have made this declaration that I am / we are fully acquainted with the local conditions in and around the site of works. I/We hereby declare that I/We have gone through the conditions laid down in the information for Tender. Conditions of Contract, Tender specifications, etc and understood the same and on the basis of the same, I/We quoted our rates in the schedule of Quantities attached with the Tender documents.

I/We shall also uniformly maintain such progress as may be directed by the Employer /Engineer to ensure completion of the same within target date as mentioned in the Tender document.

I/We declare that the submission of this Tender is being made by us and confirm that no agent, middleman or any intermediary has been, or will be engaged to provide any services, or any other item of work related to the award and performance of this Contract. We further confirm and declare that no agency commission or any payment which may be construed as an agency commission has been, or will be, paid and that the Tender price does not include any such amount.

I/We undertake to keep the process of Tender evaluation, price and other details confidential.

I/We also undertake to comply with various statutory Laws, Tax Laws, Environmental Laws and Safety measures in execution of the work.

I/We declare that if our Tender is accepted we understand that we are to be held solely responsible for the due performance of the Contract.

I we declare that we will treat as confidential all matters arising in connection with the Tender.

Signature of the Tenderer

Witness:

Address:

Seal of the Tenderer

Annexure - F

UNDERTAKING BY THE TENDERER

(as per 2.6 & 18.1 of ITT)

An undertaking to the effect to be given by the Tenderer

1. We undertake that M/s _____ _____a reputed and certified Electrical Contractor with "_____ License" for doing the "Tendered Work" NOT been Black listed /Debarred by KPTCL / BESCOM or erstwhile KEB /BBMP / any Government / Government undertaking / semi Government / PSU / Govt. Controlled Institutions/projects/ Reputed private organizations in India or Abroad.
2. We also undertake that the Tender submittals does not contain any deviation, amendment, modification or change of any type whatsoever with regard to tender conditions and specifications.

Place: Signature

Date: Name and Designation

Seal of the Tenderer

Annexure - G

WORK EXPERIENCE

Work completed of similar nature during the last five (5) years specified in ITT clause 2.3:

Sl. No.	Project Name	Name of Employer	Description of Work	Contract Number	Value of contract (INR)	Date of issue of Work order	Stipulated date of completion	Actual date of completion	Actual value of work done (INR)
1.									
2.									
…									

If any delay in completion of the work, the reasons for delay shall be explained for such work(s):
……..
……..

Place: Signature

Date: Name and Designation

Seal of the Tenderer

Annexure – H

FINANCIAL ELIGIBILITY INFORMATION

1.1 The information to be filled in by the Tenderer hereunder will be used for purpose of computing **Tender capacity** as provided for in Clause 2.4 & 2.5 of the Instructions to Tenderers.

	Description	Financial Year	Total Value of works carried out during the year (In INR)	Multiplication factor for work performed to 2022-23 level	Total value of Works updated to 2022-23
1.2	Total value of works (*) executed and payments received year wise in the last five years (in Rs. Lakhs) #	**2017 - 18**		1.61	
		2018 - 19		1.46	
		2019 - 20		1.33	
		2020 - 21		1.21	
		2021 - 22		1.10	

** ---Value of similar work as defined in ITT Clause 2*
 # --- Attach Certificate from practicing Chartered Accountant.

1.3 Information on works which are yet to be completed and works for which Tenders have been submitted as on date of this Tender.

(A) Existing commitments and on-going works:

Description of Work	Place & State	Contract No. & Date	Name and Address of Employer	Value of Contract (Rs. Lakh)	Stipulated period of completion	Value of works[1] remaining to be completed (Rs. Lakh)	Anticipated date of completion
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)

[1]Attach Certificates duly attested by the Employer or Engineers-in-Charge, of the on-going works.

B) Works for which Tenders already submitted:

Description of Work	Place & State	Name and Address of Employer	Estimated value of works (Rs. Lakh)	Stipulated period of completion	Date when decision is expected	Remarks if any
(1)	(2)	(3)	(4)	(5)	(6)	(7)

Place: Signature

Date: Name and Designation

Seal of the Tenderer

Annexure – I

Contractor's Equipment/Machinery Details

Details of Equipment/Machinery considered essential and to be deployed by the Contractor for successfully carrying out the works:

Sl. No.	Item of Equipment	Requirement[1]		Owned and available			Remarks
		No.	Capacity	Number/ Capacity	Age/ Condition	Ordered or Hired	

Place: Signature

Date: Name and Designation

Seal of the Tenderer

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PART-B

TECHNICAL SPECIFICATIONS

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PART-B

TECHNICAL SPECIFICATIONS

1. **LV CABLES, CABLE TRAYS AND STEEL WORKS**----------105

2. **LV SWITCHBOARDS AND SWITCHGEAR**----------119

3. **EARTHING**----------156

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TECHNICAL SPECIFICATIONS

1 LV CABLES, CABLE TRAYS AND STEEL WORKS

1.1 General

1.1.1 This Section specifies the Manufacture, Supply, Testing and installation of Power and Control Cables. Relevant codes and standards up to latest revision shall be applicable.

1.1.2 For Ensuring the quality aspect of the materials used by the contractors such as Cable, switches etc., it is necessary that the contractor shall furnish the approved quality control test certificates for these materials including the finished items, Department will have the right to get these materials tested at the cost of contractor.

1.1.3 It is mandatory for Electrical licensed contractor who is executing the electrical work to obtain approval from BESCOM's / KPTCL/ CEIG for arranging power supply, however necessary deposit amount shall be paid by the department.

1.2 Standards

1.2.1 Relevant Codes and Standards

1.2.1.1 The power / control cables shall comply with the latest versions of the relevant requirements of the British Standards, International Electromechanical Commission (IEC) standards and other International Standards specified in this section of Technical Specifications or approved equivalent International standards.

The following standards for XLPE, Copper cables and cable testing shall apply where appropriate:

Cable Standards and Codes- Table

STANDARDS		DESCRIPTION
BS 6724:1997		Specification for 600 / 1000V armoured electric cables having thermosetting insulation and low emission of smoke and corrosive gases when affected by fire.
BS 7211		Specification for Thermosetting insulated cables (Non-armoured) for electrical power and lighting with low emission of smoke and corrosive cases when effected by fire.
BS 7846		Specification for 600 / 1000V fire resistant armoured cables having thermosetting insulation and low emission of smoke and corrosive gases when affected by fire.

STANDARDS		DESCRIPTION
BS 7655		Specification for insulating and sheathing materials for cable. Series of standards specifying cable material having low smoke, and corrosive gas emission.
BS 6360	IEC 60228	Specification for conductors in insulated cables.
BS 6387		Performance requirements for cables required to maintain circuit integrity under fire condition.
BS4066-1 BS4066-3 BS60332-1 BS60332-3	IEC60332-1 IEC60332-3	Tests for electric cables under fire conditions.
BS 6425 / BS – EN - 50267 Part 1 and 2	IEC 60754 – Part 1 and 2	Method of determination of amount of Halogen acid gas evolved during combustion.
ASTM – D2863	ISO 4589-2	Determination of flammability by oxygen index.
ASTM – D2863	ISO 4589-3	Method for determination of temperature index.
	IEC 61034	Measurement of smoke density of electric cables burning
BS 6469 BS 50396/ BS 60811		Methods of test for insulation and sheaths of electric cables.
	IEC 60287	Calculation of continuous current rating of cables
BS 4579 BS 61238		Specification for performance of mechanical and compression joints in electric cable and wire. Compression and mechanical connectors for power cables for rated voltages up to 36 kV.
BS 6121		Mechanical cable glands
BS 7671		Requirements for electrical installations IEE wiring regulations. Sixteenth edition
BS EN 50268 - 2	BS 7622 61034 Parts 1, 2	Measurement of smoke density of electric cables burning under defined conditions.
	NES 713	Determination of Toxicity Index

(Note: In case of contradiction between various standards mentioned, the latest and most stringent standard will apply)

1.3 Technical and Installation Requirements

1.3.1 Quality Control

1.3.1.1 Cables shall be manufactured from fire resistant/retardant, low smoke and halogen free materials, and utilized at locations as specified herein.

1.3.1.2 All the cable requirements listed herein shall be met without compromising the mechanical and electrical properties of the cables both during and after installation.

1.3.1.3 The Employer's Representative / Engineer shall have such access to the premises of the Contractor / Manufacturer as is reasonable to enable him to determine the quality of the material and the workmanship and may reject any part of the cable which may appear defective either in material or workmanship.

1.3.1.4 For Underground areas such as tunnels and stations, the cables shall be XLPE insulated (except for cables as per BS 7211 (Table-3), which shall be with E1 5 insulation for applications listed in Table A1, Annexure a to BS 7211 with Low Smoke Zero Halogen (LSZH) properties as described in Clause. Further these cables should have reduced flame propagation properties to EN50268/ BS61034**.**

1.3.1.5 Cables used in external or open areas shall be ultra violet radiation stabilized.

1.3.1.6 Employer's Representative / Engineer may direct contractor / manufacturer to conduct tests listed in clause and. This shall not preclude any further tests, which may be required to determine the quality of the cable. If so desired by the Employer's Representative / Engineer, the tests shall be conducted at a recognized testing laboratory.

1.3.1.7 Unless otherwise specified, all power and auxiliary / control cables shall be rated at 600 / 1000 V for armoured and non-armoured and 450/750 V for non-armoured wires.

1.3.2 Construction Requirement for cables required for Underground Station

1.3.2.1 Power and Auxiliary Cables for use in the Underground areas of Bangalore Metro shall be of the type and manufactured to the standards as given below.

(a) Cables conforming to BS 7846: "Specification for 600/1000V fire resistant armoured cables having thermosetting insulation and low emission of smoke and corrosive gases when affected by fire "

Fire resistant / fire survival power cables shall be provided for the emergency lighting circuits, UPS supply circuits, Tunnel Lighting, battery and charger circuits, fire services installations, smoke extraction system, staircase pressurization system, fire man lifts, disable

lifts, and those circuits required to maintain circuit integrity under fire conditions. Cables for loads classified as the "Emergency" loads shall be Fire Survival type and shall conform to NFPA requirements.

(b) Cables conforming to BS-6724: "Specification for 600/1000V armoured electric cables having thermosetting insulation and low emission of smoke and corrosive

gases when affected by fire "

(c) Cables conforming to BS 7211. "Specification for Thermosetting insulated cables (Non-armoured) for electrical power and lighting with low emission of smoke and corrosive cases when effected by fire "Some of the major constructional features of these cables are described below. Further requirements additional to the standards mentioned are also described and the same must be complied with. In case of any contradiction between these the most stringent conditions will apply.

1.4 Conductors

a) The conductors shall be of stranded, high conductivity annealed copper wire complying with all the requirements of BS 6360

b) Cables for fixed installations shall have conductors with stranding to Table II Class 2 of IEC 60228, and flexible cables shall have stranded conductors to Table II Class 5 of IEC 60228.

c) Conductors shall be smooth, uniform in quality, free from scale, spills, splits and any other defects. There shall be no joints in individual strands except those made in the base rod or wire before final drawing.

1.5 Insulation

1.5.1 All cables shall be insulated with extruded Cross-linked Polyethylene (XLPE) / complying with the requirements of BS 7655 Sec.1.3 (Type GP8). However, wherever cables as per BS7211 are required, type of insulation shall be based used for installation in surface mounted or embedded conduits or similar closed systems. The insulation properties and construction shall comply with the relevant clauses of BS 6724 / BS 7211 / BS 7846 for different types of cables mentioned in Clause of this Technical Specifications. The multicore XLPE insulated cables shall be rated for continuous operation at a maximum conductor temperature of 90 ºC and for a maximum short circuit temperature of 250ºC.

1.6 Cable and Wire Colours

Cables and Single-Phase wires shall be colour coded as given below

(a) Red, Yellow, Blue Phase Conductor
(b) Black Neutral Conductor
(c) Green Earth Conductor

1.7 Fillers and Binders

1.7.1 Low Smoke and Zero Halogen Fillers and synthetic binders, compliant with the relevant clauses of BS 6724 / BS 7211/ BS 7846 for different types of cables mentioned in Clause of this Technical Specifications, shall be applied to ensure that the cable is compact and reasonably circular.

1.8 Bedding

1.8.1 The bedding shall consist of an extruded layer of low smoke halogen free bedding compound compliant with the relevant clauses of BS 6724 / BS7846 for different types of cables mentioned in Clause of this Technical Specifications.

1.9 Armour

1.9.1 Armoring shall be of galvanized steel wire compliant with the relevant clauses of BS 6724 / BS 7846 for different types of cables mentioned in Clause of this Technical Specifications. The direction of lay of the Armour shall be left hand, and the wire shall be sized in accordance with the manufacturer's recommendations.

a) Where single core cables are armoured and are in use on ac circuits, the armoring shall consist of non-magnetic material.

1.10 Over-sheath

1.10.1 The over-sheath of the cable shall be an extruded layer of anti-corrosion, reduced flame propagation, low smoke halogen free compound complying with the relevant clauses of BS 6724 / BS 7846 for different types of cables mentioned in Clause of this Technical Specifications and the fire performance requirements in clause of this M&W Specification.

a) The colour of the over-sheath shall be black.

b) Outer sheath should be of such material to make the cable rodent and termite proof.

1.11 Properties of Cable Sheathing

1.11.1 Physical properties of the cable sheathing materials shall comply with the relevant clauses of BS 6724 / BS 7211 / BS 7846 for different types of cables mentioned in Clause of this Technical Specifications and have the following requirements when tested in accordance with BS 6469/**BS 50396/ BS 60811**.

Property	**Requirement**
Minimum tear resistance	8 Nmm-1

1.11.2 a) Cables to be used should be moisture resistant and to be tested through accelerated water penetration test as per BS-6724.

b) Cables used in moist area should be corrosion resistant.

1.12 Fire Performance Requirements

1.12.1 Flammability

The bedding and over-sheath of the cable shall have a minimum oxygen index of 30 when tested in accordance with ISO 4589 – 2 / ASTM –D2863

i. The temperature index of the bedding and over-sheath of the cable shall not be less than 280°C when tested in accordance with ENISO 4589-3 / ASTM –D2863.

1.13 Flame Propagation/Integrity under Fire Conditions

1.13.1 Fire Resistant or Fire Survival Cable

1.13.2 In addition to requirement given in Clause, Fire Resistant / Survival cables shall comply with the requirements of BS 7846 and BS 6387 CategoryF2.

1.13.3 XLPE Insulated LSZH cables as per Clause (b) and(c)

a) These cables shall comply with the requirements of BS4066/**60332**/BS EN50268**61034**/IEC60332:Part1 for tests on a single cable under fire conditions when tested in accordance with that standard.

b) The cables shall comply with the requirements of BS 4066 **60332** / BS EN 50268 **61034**/ IEC 60332: Part 3 Category 'A' for tests on bunched cables under fire conditions when tested in accordance with that standard.

1.14 Corrosive and Acid Gas Emission

1.14.1 The level of hydrochloric acid gas (HCl) emission of the insulation, fillers, binder tapes, bedding, and over-sheath of the cable shall not be greater than 0.5% when tested in accordance with IEC 60754 / BS 6425 **50267** / BS EN 50267 Part 1 and 2, whichever is latest.

1.15 Smoke Emission

1.15.1 The value of smoke generated (Ao) shall meet the requirements of the relevant clauses of BS 6724 / BS 7211 / BS 7846 for different types of cables mentioned in Clause of this Technical Specifications, when a sample of the complete cable is tested in accordance with IEC 61034 / BS 7622/BS 61034 (3 m Cube Test).

1.16 Toxic Gas Emission

1.16.1 The cables should not emit toxic gases in case of fire (NES 713: Test method for determination of Toxicity Index). The toxicity Index for the cables shall be less than 3.

1.17 Cable Current Carrying Capacity and Design Parameters

1.17.1 The maximum continuous current carrying capacity and the factors for determining such ratings and temperatures, for XLPE insulated cables shall be based on IEC 60287 and on the conditions available at Site.

1.17.2 The maximum continuous rating of the cable shall be based on the following conditions:

a) Cables laid direct in ground or buried pipes:
b) Ground or duct temperature 50 °C.
c) Soil thermal resistivity ‘G’ 1.2K.m/W
d) Depth of lying to top of cable 0.8m
e) Cables in air in railway tunnels:
f) Ambient air temperature 50°C
g) Cables in air above ground: Ambient air temperature (shade) 50°C
h) Maximum continuous conductor temperature: XLPE insulated cables (up to 1000V) 90 °C
i) Rated duration for maximum short circuit current: 3sec
j) Max temperature under Short circuit conditions: 250°C

1.18 Testing of Cables and Accessories

1.18.1 All the materials employed in the manufacture of the cable shall be subjected to tests specified in relevant standards before manufacture of the cable.

1.18.2 The manufacturer must have type test certificates latest by 2 years

1.18.3 from the third-party accredited laboratories certifying compliance to all the type tests mentioned in the relevant clauses of BS 6724 / BS 7211/ BS 7846 and relevant tests mentioned in Clause. In case of non – availability of these test certificates, the manufacturer must get these cables type tested at third party accredited laboratory prior to production of cables.

1.18.4 After completion of manufacture and prior to dispatch the cables shall be subjected to routine & acceptance tests as specified in relevant standards.

1.18.5 In addition to the above tests, test certificates from the third-party accredited laboratories for the following tests must be supplied. In case of non–availability of these test certificates, the manufacturer must get these cables type tested at third party accredited laboratory prior to production of cables.

1. Accelerated water absorption test for insulation
2. Oxygen Index Test
3. Temperature Index Test
4. Smoke density test

1.19 Cable Accessories

The type tests shall include the following tests conforming to the latest IEC 502 and VDE 0278 specifications. Type test certificates shall be furnished along with the offer.

1. AC voltage with stand dry test for 1minute.
2. Partial discharge test
3. Impulse voltage with stand test with 10 impulses of each polarity.
4. AC high voltage test following load cycling test
5. Thermal short circuit test
6. DC voltage withstand test
7. Humidity test
8. Dynamic short circuit test
9. Salt fog test
10. Impact test

The Contractor shall maintain a record of test results commencing from the Manufacturer's tests conducted at the place of manufacture for comparison with the values obtained at site before and after installation. The cause for any appreciable change shall be investigated and corrective action taken as agreed with the Engineer. This record shall be a submittal at the time of handing over.

1.20 Cable Construction Identification

1.20.1 The individual cores of the cable shall be clearly identifiable in terms of phase sequence.

1.20.2 The over-sheath of the cable shall be embossed with "For BMRCL "and with the following legend*:*

Voltage Designation	Cable Marking
240/415 Volts	'Electric Cable 600/1000 V' or 'Electric Cable 450/750V'

1.20.3 A means of identifying the manufacturer, year of manufacture, conductor size and insulation type shall be provided throughout the length of the cable. If the identification is by means of embossing, it shall not affect the spacing of the legend specified above.

1.21 Cable Drums

1.21.1 Immediately after the manufacturer's tests both ends of every length of cable shall be sealed by enclosing them with Approved caps, tight fitting and adequately secured to prevent ingress of moisture.

1.21.2 The ends of the factory lengths of cable shall be marked "A" and "Z", "A" being the end at which the sequence of core numbers is clockwise and "Z" the end at which the sequence Isanti-clockwise.

1.21.3 The end which is left projecting from the drum shall be consistently "A" or "Z", and shall be protected against damage in such a manner that the enclosure cannot be easily removed during handling while in transit

1.21.4 Cable drums shall be stored on well-drained hard surfaces to preventable drums sinking and to simplify drum movements.

- Cable drums shall be stored on battens placed directly under the flanges. Storage shall be in such a manner to leave sufficient space for air circulation. Every three months of storage the drums shall be rotated 90^{o} in the direction of the arrow.
- During storage the ends of the cable shall remain properly sealed to prevent ingress of moisture.
- Adequate shelter from rain and sun shall be provided. Adequate drainage shall be provided to prevent the cable drums standing in water.
- Cable drums shall not be dropped during transit, and cranes should be employed during unloading. Cable drums should be rolled only in the direction of the arrow.
- If passing one cable to another drum, the cable drum sizes must be the same.
- During removal of the cable from the drum the minimum bending angle of 1 in 15 shall not be exceeded.
- Pulling force when using stockings shall not exceed 9Din Newton(N) where D is the outer diameter of the cable.
- Drum Lengths
- Cables shall be supplied in drum lengths as follows:
  - ✓ Medium voltage power cables up to and including 6sq. mm- 1000m.
  - ✓ Medium voltage power cables from 10 sq. mm up to and including 400sq. mm-500m
  - ✓ Control cables- 1000mA tolerance of $\pm$ 5% shall be permissible for each drum.5% of the order quantity can be supplied in non-standard lengths of not less than 100metres.

1.22 Packing

1.22.1 Cables shall be dispatched in wooden / metallic drums of suitable barrel diameter, securely battened, with the takeoff end fully protected against mechanically damage. The wood used for construction of the drum shall be properly seasoned, sound and free from defects. Wood preservatives shall be applied to the entire drum.

1.23 Marking

1.23.1 On flange of the drum, necessary information such as manufacturer's name, type, size, number of cores, voltage grade of cable, length of cable in meters, drum No, cable code, finish, gross and net weights etc. shall be printed. An arrow shall be printed on the drum indicating the direction of rotation of the drum.

1.23.2 All cable drums shall be arranged to take a 100 mm diameter round spindle and shall be lagged with strong closely fitting battens so as to prevent damage to the cable. Each drum shall bear a distinguishing number, either printed or neatly chiseled on the outside of one flange. A suitable spindle shall be provided with each consignment for loading and unloading where the gross weight of the drum and cable exceeds 10 tones.

1.23.3 The words "Running End A" or "Running End Z" as appropriate shall be marked on the flange.

1.23.4 All cables and accessories shall be carefully packed for transport and storage on Site in such a manner that they are protected against all climatic conditions, particular attention being paid to the possibility of deterioration during transport to the site by sea or over-land and to the conditions prevailing on the Site.

1.23.5 Wooden cable drums shall be suitably constructed to avoid any problem due to shrinkage. The drums shall be designed for use in conjunction with any special cable-laying equipment complete with spindles and cable drum braking gear.

1.24 Cable Installation

1.24.1 This clause covers the requirements for the use and installation of all cables on or in conduits, trays, trunking and accessories.

1.24.2 All cables shall be provided with identification labels at each end and at each position where cables change direction. In the instances where cables are multiple runs, labels shall be provided at 10 m intervals indicating run number also. Identification discs for cables installed within buildings or tunnels shall be supplied and attached with galvanized wire to each cable at intervals not greater than 12 meters and at all cable terminations.

1.24.3 Cables shall be installed in accordance with this Technical Specification and BS 7671 and shall be run between their source and termination points on or in cable ladder/trays, ducts, cable brackets, trunking and conduits.

1.24.4 Cables running horizontally at high level shall in general be supported by cable ladder and/or perforated cable trays or trunking. Where cables are installed in vertical ducts or on vertical cable ladder/tray, they shall be cleated at intervals not exceeding 1,200 mm

1.24.5 Where cables pass through fire-rated walls and floors, all openings shall be sealed with fire-resistant material of a fire rating equivalent to that of the fire rating of the wall or floor approved by Bangalore Fire Services.

1.24.6 Where cables are to be laid at ground level these may be laid in concrete duct banks (with or without conduits) or laid in GI / HDPE / RCC pipes available directly in ground as per the approval of Engineer. The cables shall be segregated according to their duty.

1.24.7 Cables shall be installed with a minimum of 300-mm clearance from any equipment or pipe work including lagging associated with other services. Where this condition is unavoidable or difficult to maintain, the Engineer shall be informed prior to the installation being commenced.

1.24.8 The power cables shall, for interference purposes be separated from the signal & communication cables in the tunnel, stations & under platform voids. Control and other cables shall be routed separately from traction or power cables. Cables shall be installed so that any one cable can be removed without disturbance to cables from other circuits in the same route.

1.24.9 Materials manufactured for use as conduits, raceways, ducts and their surface finish materials, when installed in stations and train-ways shall be capable of being subjected to temperatures up to 930□F (500□C.) for an hour, and shall conform to the National Electrical Code (NFPA 70). They shall also conform to the codes of the National Electrical Manufacturers Association (NEMA), the American National Standards Institute (ANSI), and

Underwriters Laboratories, Inc. Materials manufactured for use as conduits, raceways, ducts and their surface, finish materials when used for emergency power circuits shall be strong and durable.

1.24.10 All cable routes near tracks are to be parallel or perpendicular to the running lines.

1.24.11 In general, two cable routes shall be constructed, one each for Up and Down lines, with minimum changes of directions. Bends shall not be less than the manufacturer's recommended minimum bending radius for the cables to be installed.

1.24.12 Cables passing under road and railways shall be mechanically protected (i.e. HDPE / Galvanized iron sleeves / pipes) and have a minimum cover of 1000 mm. Proper care must be taken for jointing of metallic pipes, so that they do not give way due to weight above and damage the cables.

1.24.13 Track crossings are to be at right angles and at least 2 m clear of any rail switches or crossing areas of leads.

1.24.14 All cable entries into cable pit shall have rounded edges to prevent damage to cables during installation or during service or as a result of the weight of the cables themselves bearing against the edges.

1.24.15 Unarmored cables, which are direct buried, shall be mechanically protected throughout their length such as laid in metallic pipes or by other equivalent methods

1.24.16 Cable route markers shall be installed for underground cables where cables change direction and on straight runs of cable at intervals of no more than 50m. Markers shall be of pre-cast concrete type and be marked "electrical cable" and have a projection of 200 mm above the finished ground level.

1.24.17 Cables shall be installed without tee joints.

1.24.18 Cable Armour shall be earthed at one end or both ends of the cable as required by the installation and system. Cleats shall be of the moulded reinforced nylon type of low smoke and halogen free materials.

1.24.19 Where cables are laid in concrete troughs, the trough opening shall be sealed with concrete slabs.

1.24.20 Bends in cables shall have an internal radius of not less than six times the overall cable diameter, or as specified by the cable manufacturer.

1.24.21 Where cables are laid in open ground, they shall be bedded in 75 mm of sieved sand, covered with a similar material, and protected by concrete slabs or interlocking tiles, and the trench shall then be back filled. Medium voltage and signaling cables shall have a minimum cover of 750mm

1.25 Installation of Insulated Power Cables

1.25.1 The installation and handling of cables shall be undertaken at all times by adequate and suitably trained staff, equipped with all the necessary plant, equipment, tools and lighting.

1.25.2 Every precaution shall be taken to ensure that the cables and accessories are not installed in a manner or under conditions likely to cause electrolytic or other corrosive action or damage to the cables, or be detrimental to the performance of the cable during operation.

1.25.3 The cable system shall be fully protected from mechanical damage and be accessible at all points for inspection.

1.25.4 All cables installed shall conform to the relevant International standard for acceptable bending radius.

1.25.5 In case, it is unavoidable, to cut any cables during installation, all cut ends shall be properly sealed.

1.25.6 All transitions where cables pass from one graded area to another shall have an approved means of sealing the aperture against fire transference.

1.25.7 The maximum pulling force on any cable shall not exceed the design force of the cable.

1.25.8 All bolts, studs and nuts supplied shall comply with the relevant requirements.

1.25.9 All exposed metalwork surfaces shall be properly painted, finished and galvanized as per relevant specifications.

1.26 Installation of Cable Supports for Insulated Power Cables.

1.26.1 The design of all support and fixing items shall ensure freedom from rough edges, burrs and sharp corners. No materials shall be used which will promote electrolytic or other corrosive action in contact either between the various parts, or with the cable sheaths or the building surfaces and other materials with which they may make contact. All cable supports shall be hot dipped galvanized.

1.26.2 Hot dipped galvanized cable supports that are subject to excessive humidity shall be protected with an approved coating.

1.26.3 The cable supports required for the installation of single-core cables forming three phase circuits shall permit the cables to be laid in close trefoil formation in case of three-phase circuit without neutral conductor or quadrature formation in case of three-phase circuit with neutral conductor. Non-magnetic metal cleats shall be used for this purpose. Low smoke halogen free packing material shall be applied between the cables and the cleats to avoid damaging the cable sheath by the installation of the cleats.

1.26.4 Where single core cables in trefoil or quadrature formation are secured in cleats, intermediate binders of approved material and construction shall also be fitted around the formation to prevent the cables separating under fault conditions. The binders shall be secured around the cables by means of a bolted connection with low smoke halogen free packing material applied between the cable and the binder.

1.26.5 Unless otherwise indicated on the Drawings, all non-armoured cables, where required to be run on walls, ceilings or other building structures, shall be secured or enclosed in conduit or trunking. Armoured cables shall generally be supported by cable ladder Trays, cable Perforated trays or cable brackets.

1.26.6 Every cable, whether in or out of sight, shall be neatly run vertically, horizontally or parallel to adjacent walls, beams or other structural members.

1.26.7 Spacing of clips, saddles and cleats shall be such as to prevent sagging of the cables at all times during their installed life.

1.26.8 All steel trays, supporting steel work, brackets, clamps, hangers, cleats, saddles and other

fixings necessary for the support of the cables shall be approved by the Engineer, and be of adequate strength for the cables they are supporting. All supporting steelwork and brackets shall be fitted with adjustable mechanisms. Where a number of cables are terminated to any particular item of plant or machinery, special care shall be taken to ensure that the cables finally approach the plant or machinery from a common direction and are individually terminated in an orderly and symmetrical fashion.

1.26.9 At joints and terminations, all cables shall be adequately supported and secured by cable cleats at a distance of not more than 300mm from the glands or joints.

1.26.10 LV power cables terminated onto the LV cable box of the Distribution transformer shall not impose load on the LV cable box to cause sagging, distortion, etc.

1.27 Termination

1.27.1 The terminating kits shall be suitable for termination of the cables on an indoor switchgear or equipment. These shall be of proven design and shall be type- tested as per relevant Indian or International Standards. Type test certificates shall be submitted. The cable and wire terminations shall avoid any possibility of loose joint and wire snapping. Cable conductor termination shall be by means of a heavy-duty solder less cable lug. The lug shall be of high conductivity copper, electro-tinned and applied to the conductor by means of a hydraulic crimping tool. All such crimping should meet the requirements of BS 4579/BS61238.

1.27.2 The cable sheath shall be clasped by means of a gland of compression type based on BS 6121 or equivalent Indian standard with a compression washer, which will hold the cable sheath securely. A cable shroud shall be fitted to cover the body of the compression gland.

1.27.3 All wires shall be terminated with an Approved type of connector.

1.28 Cable Glands and Accessories

1.28.1 Non-Armoured Cables

1.28.2 All cable glands and accessories shall be to BS 6121 or equivalent Indian standard. The cable glands shall have a watertight seal when fitted to a cable. Each cable gland shall be supplied with a brass gland locknut and a flame-retardant low smoke halogen free outer gland shroud. The shroud shall totally enclose the gland body and form an effective seal against the cable sheathing.

1.29 Armoured Cables

All cable glands and accessories shall be approved to BS 6121 or equivalent Indian standard.

a) The cable glands shall have a watertight seal when fitted to a cable.
b) Cables shall be terminated in a gland fitted with an amour clamp and an earth ag. The gland body shall be provided with an internal conical seal to receive the amour clamping cone, and a clamp nut, which shall secure the Armour-clamping cone, and conical Armour seal. The spigot of the gland body shall be threaded to suit standard conduit accessories. A flame-retardant low smoke halogen free shroud shall be fitted to cover the gland body.

1.30 Cable Ties

1.30.1 Cable ties shall be used, free from corrosion resistant, flame retardant and ultra violet stabilized materials. At locations where cables are installed at Undercroft, Tunnel and tracks areas subjected to significant and constant vibration, cable ties shall be of metal construction type and coated with a corrosion resistant, low smoke halogen free and flame-retardant insulation material.

1.31 Cable Joints

1.31.1 The straight through jointing kits shall be suitable not only for conditions of high humidity encountered in Metro sub-way, but also for underground buried installation with uncontrolled back-fill and possibility of flooding by water. These shall be of proven design and shall be type-tested as per relevant Indian or International standards. Type test certificates shall be submitted.

1.31.2 The jointing kits shall match the cable specifications. Joints shall not be permitted in the fire survival cables in case the joint does not meet the fire survival conditions.

1.31.3 Every connection at a cable joint shall be mechanically and electrically sound, be protected against mechanical damage and any vibration, shall not impose mechanical stress on the fixings of the connection and shall not cause any mechanical damage to the cable conductor.

1.31.4 The appropriate tools specified by the joint manufacturer shall be used when jointing cables.

1.31.5 The outer casing/outer sheath of the cable joint shall be fabricated from a low smoke halogen free material.

1.31.6 No cable joints shall be allowed without the prior Approval of the Engineer / Engineer. All joints, accessories and cable joint locations shall be submitted to the Engineer for Approval prior to any jointing of cables. All cable jointing shall be performed by a qualified jointer and preferably by the manufacturer of the jointing kits.

1.32 Cable Identification

1.32.1 All cables shall be provided with identification markers, at each end of the cable, at entry and exit point of cable trays, ducts and trenches and in other such positions as are necessary to identify and trace the route of the cable. Identification discs for cables installed within buildings or tunnels shall be supplied and attached with galvanized wire to each cable at intervals not greater than 12 meters and at all cable terminations.

1.32.2 Cable identification shall be assembled from elliptical profiled low smoke halogen free markers, carrier strip and cable ties.

1.32.3 Every single core cable and every core of a multi-core cable shall be provided with identification at its terminations in the form of sleeves or ferrules of appropriate colours or as specified for signaling cables.

1.32.4 Screened Signal and Control Cables

1.33 General

1.33.1 The control cables shall meet the requirement specified in this Section.

a) Cables for protection and control functions associated with the Power Supply System and Fire Alarm System, and used on line-side routes, shall be armoured Twisted Pair Screened cables and shall be low-smoke, non- halogenated type where used on underground sections or in enclosed public areas. All critical control cables shall be duplicated and run separately in the underground section. SCADA related wiring shall be terminated in supervisory termination cabinets.

1.33.2 The control cable shall be heavy-duty type, 600V / 1000 V grade LSZH (complying with the standards BS 6724 and BS 7846, as specified above for Power and Auxiliary cables and fire performance requirements specified in Clause of this Technical Specification.), nil halogen with stranded copper conductor of size not less than 2.5 sq. mm. The outer sheath shall also be mixed with chemicals for protection against rodent and termite attack. Wherever specified, fire resistant type cable shall be provided.

a) All wires for Fire Alarm System shall be with Fire Survival Type of Cables. , complying to CWZ category.

1.34 Conductors

a) The conductors shall be of stranded, high conductivity annealed copper wires complying with BS 6360/BS60228.
b) Flexible cables and cables for fixed installations shall have stranded conductors.
c) Conductors shall be smooth, uniform in quality, free from scale, spills, splits and any other defects. There shall be no joints in individual strands.
d) All signal /control copper armoured cables shall be rated at 600 / 1000 V whilst non-armoured cables shall be rated at 450 / 750 V and have a minimum cross-sectional area of 2.5mm².

1.35 Screening

a) Screening shall be achieved by the use of laminated tape, consisting of an aluminum foil bonded to a polyester film for the strength, applied to the cable with an overlap so that full 100 % coverage of the conductors is afforded.
b) The cable shall be individually screened pair cables to provide improved cross talk immunity characteristic if required.
c) A drain wire or continuity conductor, laid under and in contact with the aluminum foil shall be provided. The tinned annealed copper conductor may be of solid or strand construction, using the approved manufacturing technique.
d) The maximum resistance of the drain wire or continuity conductor provided shall meet with the requirements of BS 6360/BS60228.

2.0 LV SWITCHBOARDS AND SWITCHGEAR

2.1 General

2.1.1 This Section specifies the Design, manufacture and installation of Low Voltage Panels (MDBs/SUB-MDBs). Relevant codes and standards up to latest revision shall be applicable.

2.2 Reference Standards and regulations

2.2.1 The following Reference Standards are considered but not limited for LV Electrical Distribution System.

STANDARDS	DESCRIPTION
IEC 61439-1:2020	Low-voltage switchgear and control gear assemblies - Part 1: General rules
IEC 61439-2:2020	Low-voltage switchgear and control gear assemblies - Part 2: Power switchgear and control gear assemblies
IEC TR 61641:2014	Enclosed low-voltage switchgear and control gear assemblies - Guide for testing under conditions of arcing due to internal fault.
IEC 60529/-2004	Specification for degrees of protection provided by enclosures (IP code).
IEC 62262:2002	Degrees of protection provided by enclosures for electrical equipment against external mechanical impacts (IK code)
IEC 60255-2009	Measuring relays and protection equipment - Part 151: Functional requirements for over/under current protection
IEC 60947-1:2016	Low-voltage switchgear and control gear - Part 1: General rules.
IEC 60947-2:2016	Low-voltage switchgear and control gear - Part 2: Circuit-breakers.
IEC 60044-1:2010	Instrument transformers. (CT & PT)
IEC-1036, 687, 1286	Direct reading single / three phases meter (Digital Type).
IEC 61557-12:2018	Electrical safety in low voltage distribution systems up to 1 000 V AC and 1 500 V DC - Equipment for testing, measuring or monitoring of protective measures - Part 12: Power metering and monitoring devices (PMD)
IEC 62053-22:2020	Electricity metering equipment - Particular requirements - Part 22: Static meters for AC active energy (classes 0,1S, 0,2S and 0,5S)
IEC 62053-23:2020	Electricity metering equipment - Particular requirements - Part 23: Static meters for reactive energy (classes 2 and 3)
IEC 60521: Class 0.5, 1 and 2	Alternating-current watt-hour meters.
BS 381C/BS 4800:	Specification for colors for identification, coding and special purposes.
BS 1432: -1987	Specification for copper for electrical purposes: high conductivity copper rectangular conductors with drawn or rolled edges

STANDARDS	DESCRIPTION
BS 1650-1:1950	Specification for industrial capacitors for connection to power-frequency systems
BS 2757: 1986	Method for determining the thermal classification of electrical insulation.
BS 5685: 1992	Electricity meters.
IEC 60228/BS 6360:	Specification for conductors in insulated cables and cords.
BS 7211:1998	Electric cables. Thermosetting insulated, non-armoured cables for voltages up to and including 450/750 V, for electric power, lighting and internal wiring, and having low emission of smoke and corrosive gases when affected by fire (FRLSZH)
IEC 60185/BS 3938:	Specification for current transformers.
IEC 60051-1 :2016	Direct acting indicating analogue electrical measuring instruments and their accessories.
IEC 60255-27:2013	Measuring relays and protection equipment - Part 27: Product safety requirements
IEC 60947 -3 :2020	Specification for low-voltage switchgear and control gear. Switches, disconnectors, switch-disconnectors and fuse-combination units.
IEC 60947-4-1:2018	Specification for low-voltage switchgear and control gear. Contactors and motor-starters. Electromechanical contactors and motor-starters.
IEC 60211:2019	Maximum demand indicators, Class 1.0.
EN 60742/BS 3535:	Isolating Transformers.
BS 951 :2009	Electrical earthing. Clamps for earthing and bonding. Specification
IEC 60529/EN 60529:	Degrees of protection provided by enclosures (IP Code).
IEC 60831:2014	Shunt power capacitors of the self-healing type for AC, systems having a rated voltage up to and including 1100 V.
IEC 60871-1:2014	Shunt capacitors for AC power systems having a rated voltage about 1100 V.
BS EN 10025 6:2004	Hot rolled products of structural steels. Technical delivery conditions for flat products of high yield strength structural steels in the quenched and tempered condition
BS 37-1 :1952	Specification for electricity meters. General clause
IEC 61643-11: 2011	Low-voltage surge protective devices - Part 11: Surge protective devices connected to low-voltage power systems - Requirements and test methods
IEC 62262.:2002	Degrees of protection provided by enclosures for electrical equipment against external mechanical impacts (IK code)
IEEE 519 – 2014	Guide for Harmonic Control and Reactive Compensation of Static Power Converters.

2.3 Technical and Installation Requirements.

2.3.1 General Requirements

a) The LV main switchboards shall be Type Tested Assemblies (TTA) as defined in IEC 61439-1& 2:2020 Form 4b Type 6 built up from compartments housing circuit breakers, control gear, relays, Busbars, controls and other items of equipment.

b) The Type test certificate for fully assembled LV switch boards shall Comply to the latest IEC 61439-1& 2:2020 only as per required rating. For this OEM must produce all the test certificate from the NABL accredited lab CPRI/ERDA only.

c) The LV main switchboards shall also pass the Arc fault containment tests in accordance with IEC61641 with minimum 65KA for 0.3 sec continuously. In this course of the test the breaker should carry the fault current for the complete test time or Voltage shall be maintained for the entire test. Internal arc test should comply with edition 3, Class C & complying to all the criterion 1 to 7 of IEC 61641.For this Switchgear OEM shall produce the type test certificate from NABL accredited lab CPRI /ERDA only. Certificate shall be within the last five(05) years.

d) Switchgear OEM has to give the full discrimination report along with selection chart. discrimination must be done up to the incomer breaker Breaking capacity.

e) All panels should be factory built from OEM and should be supplied through authorized / licensed channel partner. The design of the switchboard shall be proven design from the main Switchgear manufacturer (OEM) and OEM shall submit type test certificates

f) In Panel Breaker ACB, MCCB, and MFM Meter has to with inbuilt communication within releases RJ45 port with Modbus TCP/IP Communication. It includes SPD status All and the RJ45 Port must be connected through Managed Ethernet Switch as common. From their it will connect to SCADA & BMS control panel via Modbus TCP/IP protocol.

g) For MDB 100, 200 & DG syn panel -HMI (Panel View) 1 no each with pass word protection. 15 Inch Advanced TFT screen XGA 1024*768 Pixels Modular construction, with 2 Modbus TCP/IP Ethernet Ports, 2 serial ports, SD card, 512MB back up memory, configuring all devices in Modbus TCP in IEC61131-2 compliant, UL 508 compliant, RoHS complaint.

h) All the Panel incomer MCCB must be electrically operated and draw out type.

i) The complete units shall be suitable for service on a 415 V, ±5%,3 phase 4 wire, 50 Hz supply.

j) The LV main switchboards and the associated equipment, including switchgear, control gear and bus bar assemblies shall be certified for the category of duty specified. The LV Main Switchboard shall be identical in mechanical construction to the LV Switchboard which had been type-tested by an acceptable, accredited and independent testing laboratory for the fault conditions, temperature rise limits and arc fault containment. Any manufacturer not having the above will not be considered for supply. The main circuits of the LV main switchboards shall have an insulation voltage of 1000 V AC.

k) The design temperature for the equipment provided in the main LV switchboards shall be 45 °C. The relative humidity upto 75% at an Ambient temperature of 45 °C.

l) The secure service life of equipment used for switchboards, sub-assemblies and components shall be at least 30 years.

m) Where armored multicore cables terminate inside the switchboard enclosure, gland plates or gland brackets shall be provided for securing the cables to the switchboard.

n) Gland plates, gland brackets and extension boxes shall be removable and shall be of adequate size for the cables to be terminated.

o) All the control wire FRLSZH must be terminated with Polycarbonate-Insulated copper fork terminals. UL 94 Flammability rating v-2 of insulation must use.

p) In the Panel all the lugs for power must min 2 hole with High conductivity copper tube metal Bare as a material with voltage rating up to 600V with min 35KA per Lug

q) Separate current transformers shall be provided for each protection device and for instrumentation.

r) Panel temperature must be monitored in Busbars of RYB terminals, and incoming RYB terminals. The temperature must be displayed in respective I/C and OG Breaker's Once temperature exceeds 50'C it must give the Alarm and 75'C it must give the signal to BMS and SCADA.

s) The switchgear assembly/sub-assemblies or panels shall be termite and rodent proof.

t) The switchboard shall have sufficient space to house all electrical equipment allowing for 25% spares feeder for the future expansion. Any equipment which comprises an assembly of similar modules shall be constructed such that further similar modules can be added at either end.

2.3.1.1 Panel must be tested with Impulse test of 8 KV & duration of test as per clause No– 8.5 of IEC 61641 – 65 KA @ 0.3 Sec Min at cable chamber. Copies of the test certificates shall be submitted along with the bid. The LV main switchboards and the associated equipment, including switchgear, control gear and busbar assemblies shall be certified for the category of duty specified. The LV Main Switchboard shall be identical in mechanical construction to the LV Switchboard which had been type-tested by an acceptable, accredited and independent testing laboratory for the fault conditions, temperature rise limits and arc fault containment. Any manufacturer not having the above will not be considered for supply. The main circuits of the LV main switchboards shall have an insulation voltage of 1000 VAC.

2.3.1.2 The protective earthing configuration shall be TN-S unless otherwise specified.

2.3.1.3 The secure service life of equipment used for switchboards, sub-assemblies and components shall be at least 30years.For this switchboard and switchgear OEM has to give the supporting documents.

2.3.1.4 Where armored multicore cables terminate inside the switchboard enclosure, glanding plates or glanding brackets shall be provided for securing the cables to the switchboard.

2.3.1.5 Glanding plates, glanding brackets and extension boxes shall be removable and shall be of adequate size for the particular cables to be terminated.

2.3.1.6 Separate current transformers shall be provided for each protection device and for instrumentation.

2.3.1.7 The switchgear assembly/sub-assemblies or panels shall be termite and rodent proof. The sub-assemblies of similar equipment shall be interchangeable.

2.3.1.8 The switchboard shall have sufficient space to house all electrical equipment allowing for 25% spare feeder for future Expansion. Any equipment which comprises an assembly of similar modules shall be constructed such that further similar modules can be added at either end.

2.3.2 Quality Control

2.3.2.1 **Workmanship**

(a) All similar items of the LVSBs and their component parts shall be completely interchangeable. Spare parts shall be manufactured from materials similar to the originals and shall fit all similar items of the LVSBs. Where machining may be needed before fitting renewable parts, the machining fits and the associated tolerances shall be shown on the drawings accompanying the instruction manuals.

(b) All parts which are susceptible to wear or contaminated by dust shall be totally enclosed in dust-proof housings.

(c) The LVSBs shall operate without excessive vibration and with a minimum of noise, and shall also operate without excessive temperature rise at the rated load conditions.

(d) The style and finish of the workmanship shall be consistent throughout the Works. Unless otherwise specified, Engineer shall decide the final colours for all paintwork and other finishes to be applied to the LVSBs.

2.3.2.2 **Tropicalisation**

(a) All items of plant shall be tropicalised to suit the conditions prevailing in India in general and within the substations and plant rooms.

(b) Enclosure must be Modular in construction welding is not allowed because of topicalization.

(c) Modular Enclosures shall provide the required degree of protection IP54.

(d) Operating coils shall be vacuum impregnated with waterproof insulating varnish or epoxy-resin encapsulated.

(e) Wire-wound resistors shall be of ceramic formers and embedded in fireproof and damp-proof material.

(f) CT windings shall be epoxy-resin encapsulated against the ingress of moisture.

(g) Panels shall be provided with necessary lighting arrangements for maintenance.

2.3.3 Low Voltage Switchboards Cubicle Construction

2.3.3.1 The equipment shall be arranged within each compartment such that all normal maintenance can be carried out through hinged access doors or removable covers, and where possible from the front. The switchboard shall have a rated short time withstand current of 65 KA for 1 second and a fault withstand classification of Class 3 for a supply voltage of 415V AC between phases at 50Hz. The main switchboards shall be a minimum of Form 4b Type 6 in accordance with IEC 61439-1 &2

2.3.3.2 Electrical panel shall be tested IK10 for mechanical impact in accordance with IEC 62262;2002.

2.3.3.3 Protection against shock in normal service shall be achieved by the provision of barriers or enclosures both vertical and horizontal and between adjacent units to ensure segregation and prevent accidental contact with live parts, or by complete insulation of all live parts. Control cables shall be segregated from primary conductors.

2.3.3.4 The LVSBs shall be designed for indoor use in the form of free standing, floor mounting, extendible, self-contained, flush fronted cubicles and sectionalized as necessary to facilitate easy transportation and erection, containing all the equipment indicated on the Drawings and specified hereinafter. The Switchboard shall be complete with all components and accessories, which are necessary or usual for their efficient performance and satisfactory maintenance under the various operating and atmospheric conditions. Such parts shall be deemed to be included within the scope of supply whether specifically included or not in the specifications or in the tender schedules. The contractor shall not be eligible for any extra charges for such accessories etc.

2.3.3.5 The LVSBs shall be provided with front and back access and the maximum height shall not exceed 2.40 m. All relays and indicating instruments shall be at least 500 mm and not higher than 1.8 m above floor level. The clearance in front, back and side of all assemblies of switchgear and control gear shall be generally not less than 1.2 meters. The switchgear shall be considered in the fully drawn-out condition for this purpose.

2.3.3.6 The cubicle section shall be constructed of angle iron type frames and folded sheet steel or fully bolted construction with all necessary removable covers. Removable lifting lugs shall be provided on the top of the cubicles. Cubicle sections shall be provided with bolts or devices for ensuring that they are correctly aligned when being coupled together. The busbar chambers shall be fitted with removable end cover plates secured by Galvanized steel captive screws.

2.3.3.7 The degree of Ingress Protection for Main LV Switchboards shall be IP-54 which shall not deteriorate with time.

2.3.3.8 Various units comprising a complete LVSBs shall be grouped in a multi-tier arrangement including a cabling and wiring chamber of ample dimensions to accommodate terminal blocks, cable boxes and gland plates.

2.3.3.9 In TTA panel all the Bolts and nut’s must be stainless steel only with suitable two-sided plate washer and Spring washer.

2.3.3.10 Adequate maintenance access shall be provided to equipment within the LVSBs. De mountable panels shall be provided at the back of the LVSBs that can be handled by a single person. Every demountable panel shall be provided with a pair of handles for easy removal and fixing.

2.3.3.11 The MDB/SMDBs shall be constructed of nominal 2 mm CRCA thick sheet steel. Front

access door shall be fixed with concealed hinges and interlocked with the switch mechanism. The top, sides and rear cover plates shall be removable and attached to the frame with rustproof screws. The front glass doors shall be attached the frame with the hidden hinged and approved keys providing easy opening to the doors. All front plate used for mounting meters, selector switches or other front mounted devices shall be hinged with all wiring installed and laced with flexibility at the hinged side. The back-enclosure plate shall also be hinged type and other closure plates shall be screw removable and small enough for easy handling by one man. The door panel can be opened only if the switchgear is in the “OFF” position. It shall be finished to provide a rigid shell type of enclosure in accordance with BS EN 10137/10025.

2.3.3.12 ARC chutes and ventilating outlets shall be so situated that any emission of flame or hot metal particles shall not cause electrical breakdown and shall be directed away in such a manner as to avoid endangering the operator

2.3.3.13 Ventilating louvres where required shall be provided on the sides of the panels and shall be of the approved design to suit local conditions.

2.3.3.14 Adequate arrangements for air circulation shall be made within each compartment of the LVSBs. The Contractor shall ensure that the internal temperature of the LVSB will be well within the operating ranges as specified by IEC 61439-1of all electrical and electronic components including switchgear, control gear, Busbars, relays, wiring and timers inside the LVSBs.

2.3.3.15 All interior shall be completely factory assembled with circuit breakers and wire connections. All wire connectors, except screw terminals, shall be of the anti-turn solder-less type and all shall be suitable for copper wire of sizes indicated. Interiors shall be so designed that circuit breakers can be replaced without disturbing adjacent units and without removing the main bus connectors and shall be so designed that circuits may be changed without

2.3.3.16 Busbars, risers and droppers, and cable terminations including cable lugs, bolts and nuts, shall be fully insulated. This shall be achieved by applying heat shrinkable materials to the Busbars and shrouds at the busbar joints and cable terminations. All insulation materials used shall be low smoke halogen free.

2.3.3.17 The LVSBs shall be mounted on a robust base frame made up of steel channels with a minimum height of 100mm. The base frame shall be able to withstand the static and dynamic loads of the LVSBs. The steel channels shall be painted with epoxy polyester paint.

2.3.3.18 All steel parts of the panel shall be completely dry and chemically clean, prevent corrosion, before being painted with the non-rusting primer and not less than two stoves enamel-coating finished on top both inside and outside. Finish shall be light grey with RAL standard color 7035, unless otherwise directed by the Employers Representative

2.3.3.19 Non-magnetic gland plates of not less than 3.2mm thick with bracing of suitable size shall be provided at the top and bottom of the LV main switchboards for the termination of incoming and outgoing power cables or busways.

2.3.3.20 Connections: All the incoming / outgoing terminations shall be extended via fully insulated copper connections into a separate termination chamber adjacent to the rear of the switchboard. When busbars are used between switchboards, the internal busbars of the switchboard shall be in fully insulated copper bars of the same size as the switchboard busbars. No linking with cables shall permitted in this case.

2.3.4 Low Voltage Main Switchboards Earthing

2.3.4.1 A continuous copper earthing busbar shall be provided along the whole length of each LVSB and shall be provided with terminals for connections to the metal housings of incoming busways, cable trucking's, and cladding or armouring of all incoming and outgoing cables and to the substation earth. The copper earthing busbar shall be tin-plated and with a cross-sectional area of not less than 400 Sqmm.

2.3.4.2 Switchboards shall be provided with two earthing terminals, one at each end, for the connection of sleeved Copper bars for earthing. The earthing bars shall be fixed at rear interior bottom portion throughout the length of the switchboard, bonding all gland plates, and other component parts of the switchboard to a main earth point adjacent to the intake position in accordance with BS 951:2009 and BS7430.

2.3.4.3 All non-current carrying metallic components shall be permanently connected to earth.

2.3.5 LVSBs Electrical Safety Arrangements

2.3.5.1 All terminals, connections, relays and other components which may remain live when access doors are open shall be screened. It shall not be possible to obtain access to an adjacent cubicle when any door is opened.

2.3.5.2 Where several outgoing circuits occupy a common cabling chamber, all copper work, cable lugs with two holes, terminations and terminal blocks shall be fully segregated by compartmentation to enable work on any one circuit to be carried out with other circuits remain live.

2.3.6 Busbars

2.3.6.1 Busbars and busbar connections shall be constructed in accordance with the requirements of IEC 61439-1 &2. Or Based on insulated conductor rating (IS:8084-1976) and the maximum current density for copper shall be 1.4A per mm2 for ratings up to 800A and beyond 800A maximum current density shall be 1.2A per mm2. Bus bar supporting system shall be suitable to withstand the stresses of a 31 MVA sustained symmetrical fault level at 415 volts for 1 second or as per schedule of quantities.

2.3.6.2 The short-time withstand current rating shall be as per SLD drawings or BOQ for 1 second at 415V

2.3.6.3 Busbars shall be of rectangular section hard drawn high conductivity copper to BS 1432 /13601, adequately rated and supported by non-tracking moulded insulators spaced at suitable intervals. The complete assembly shall be capable of withstanding the maximum mechanical stresses to which it may be subjected to under fault conditions.

2.3.6.4 The bus bar connections shall be as per IEC 61439-1-2 Total type tested design.

2.3.6.5 Neutral bus shall be furnished through the entire length of the switchboard. Neutral bus size shall not less than full size of phase bus and shall have the same bracing. All switchboard equipment requiring neutral shall be connected to this bus. Bolted type terminal lugs shall be furnished for connecting the neutral bus to the incoming and outgoing cables.

2.3.6.6 The Bus bar shall be air insulated, solid rectangular bars of electro-tin plated, hard drawn, high conductivity, 98%, copper bars and shall be mechanically braced to withstand the maximum symmetrical short-circuit current rating of the main breaker in each assembly

2.3.6.7 Bus-bar holder shall be of fiber-glass reinforced polyester (FRP) type or Epoxy- resin. The calculation sheet and technical data showing the minimum spacing between the bus-bar holders for withstand the maximum force caused by short circuit current from the bus-bar holder's manufacturer shall be submitted for Notice of No objection. The horizontal main bus-bar supports, connections, and joints shall be bolted to be free of required periodic maintenance.

2.3.6.8 Busbar, busbar connection and conductors forming part of the equipment of the switchboards shall comply with IEC 61439-1&2 on current carrying capacity and limits of temperature rise.

2.3.6.9 The main busbars shall be so positioned and arranged that all busbar risers and droppers can be brought onto the main busbars without undue bending. Busbars shall be separated and supported with appropriate clearances in air in addition to the requirement of providing full insulation. Busbars shall be colored for phase identification. The material for phase identification shall be non-colour fading and use of adhesive label shall not be acceptable.

2.3.6.10 All conductors between the busbars and the switchgear shall be of high conductivity copper bar, having a current rating of not less than that of the frame size of the switchgear to which they are connected. The conductors shall be insulated and colour coded for phase identification.

2.3.6.11 The busbars shall be extendible from both ends.

2.3.6.12 The maximum temperature of the bus-bars and the bus connections shall not exceed $90^{o}C$.

2.3.6.13 The temperature rise tests shall be carried out at full rating of rated current for all busbars. Type test certificates for temperature rise shall be given for acceptance.

2.3.7 Polarity

2.3.7.1 The polarity of all apparatus shall be arranged as follows when viewed facing the front of the LVSBs:

(a) For two pole apparatus, phase pole and neutral pole when reading from top to bottom or left to right; and

(b) For three or four pole apparatus, red, yellow and blue phases and neutral when reading from top to bottom or left to right.

2.3.7.2 All cables shall be so connected within the LVSBs such that the correct sequence is preserved throughout.

2.3.8 Terminal Blocks (Push in technology- Tool less)

2.3.8.1 Terminal blocks for low voltage wiring shall be moulded from high grade non – hygroscopic melamine, comprise banks of rail-mounted blocks with all live parts fully shrouded, screw- clamp, spring- loaded insertion, solder-lug or stud type terminals as appropriate to the design and duty of the cables to be terminated. Pinch-type screws, where the screw is in direct contact with the conductor, shall not be used.

2.3.8.2 Each terminal shall be provided with claw-type washers, crimp lugs or other approved means for connection of the wires. Plain and spring washers, nuts and lockouts shall be electro-tinned.

2.3.8.3 Terminals shall be assembled in banks and each terminal shall be complete with marking tags to fit into moulded tag slots.

2.3.8.4 Terminals for final connections for indication, instrumentation and metering circuitry shall have test probe facilities and an integral disconnecting device to facilitate testing.

2.3.8.5 Terminations shall be grouped according to function and no more than two wires shall be connected to one terminal. Labels shall be provided adjacent to the terminal blocks to identify the function and voltage of each group.

2.3.8.6 All terminals to which 240 V or 415 V AC circuits are connected, where they are not housed in individual terminal blocks, shall be provided with a transparent insulated cover which, in addition to any other form of identification and shall have a label engraved suitably indicating the voltage.

2.3.8.7 Terminals for the control supply which may be still alive when the main equipment is isolated from the mains supply shall be suitably labelled to reduce the risk of accidental contact.

2.3.8.8 All terminals shall bear a permanent identification number or letter.

2.3.8.9 Each terminal block compartment within the LVSBs shall have not less than 20 % or 4 spare terminals whichever is greater.

2.3.9 Internal and Control Wiring

2.3.9.1 All equipment shall have adequate provision for the entry and termination of all associated power and auxiliary cables.

2.3.9.2 Cable entry shall in all cases, except where otherwise specifically approved, be at the base of the equipment. FRLSZH and Fire Survival Cables shall be as provided as per engineer approval.

2.3.9.3 All cabling and wiring within the LVSBs shall be neatly run and fitted in or upon such cable trays, turnings and conduits as may be appropriate to the layout and equipment. Cable trays, trucking's, conduits and cleats shall be non - metallic and shall be of the low smoke halogen free material.

2.3.9.4 All internal and control wiring shall be Fire Retardant Low Smoke Zero Halogen (FRLSZH) copper conductor wires rated at 450/750 V complying with BS 7211 and Section 5.0 of Technical Specification. All control wiring within the LVSBs shall be with single core; minimum 2.5 mm² copper conductor complying with the requirements of this Clause. Insulation shall have a glossy finish, be resistant to oil and be incapable of supporting combustion.

2.3.9.5 Different insulation colours shall be provided to distinguish the various circuits. All wiring shall conform to the colour and ferrule codes to be approved by Engineer.

2.3.9.6 All internal wiring shall be neatly run and securely fixed in non-metallic cleats in such a manner that, wherever practicable, wiring can be checked against diagrams without removal of the cleats. Wiring passing out to fully accessible positions shall be run in non-metallic low smoke halogen free flexible tubes or conduits.

2.3.9.7 Bus-wires shall be fully insulated. Bus-wires terminals shall be fully accessible from the point of entry to each enclosure. MCB and links shall be provided to enable all control circuits within the LVSBs to be isolated from the bus-wires.

2.3.9.8 All wires between the terminals of two equipment shall be given an unique number according to an approved system. A wire number shall not change solely by virtue of passing through, say, a marshalling terminal block.

2.3.9.9 In the interests of uniformity, the wire-numbering system shall be approved by the Engineer.

2.3.9.10 Identification markers shall be fitted to all wires and multicore cable tails within enclosures in accordance with the diagram for the apparatus concerned. Cable and core markers shall be of insulation material, coloured according to the wire-numbering system, with a glossy finish, be resistant to oil and be incapable of supporting combustion. Numbers shall not be duplicated unless the corresponding wires are directly in series or parallel.

2.3.9.11 Where inter-panel wiring passes through panel side sheets etc., the access hole shall be fitted with a suitable grommet.

2.3.9.12 There shall be no joint in conductors between terminal points.

2.3.9.13 Terminations for terminals shall be of the crimped-on ring type. Terminations of stranded conductors to clamp type terminals shall be of the crimped-on solid rod type.

2.3.9.14 No more than one core of either internal or external wiring shall termination any outgoing terminal. Where duplication of terminal blocks is necessary, suitable solid bonding links shall be incorporated in the design of block selected.

2.3.9.15 Wiring for all known future equipment shall be provided and all wires shall be terminated.

2.3.9.16 Wiring from the fixed part of the switchboard to the movable part such as hinged door shall be enclosed by flexible tubing made of Low Smoke Zero Halogen material. Exposed live terminals shall be suitably shrouded or covered.

2.3.9.17 All control circuits shall be protected by MCB 0.5 A. or with adequate overload protection. For that OEM must give the load calculation.

2.3.10 Instrumentation

2.3.10.1 Instruments shall be similar in appearance throughout the whole of the LVSBs. All instruments, gauges and meters shall be of flush pattern, dust and moisture proof, suitable for the environment in which they are installed. All instruments and meters shall be completely segregated in instrument compartments. Compartments containing these devices shall not contain any terminals or equipment operating at higher voltages.

2.3.10.2 Meter shall be suitable for 3 phase, 4-wire system, With LCD display with balanced as well as unbalanced load. All instruments and associated apparatus shall be capable of carrying their full-load current without undue heating. They shall not be damaged by the passage of fault currents up to the rating of the associated switchgear through the primaries of their associated instrument transformers. All instruments and apparatus shall be flush mounted and cases shall be earthed by a conductor of not less than 2.5mm² cross-sectional area.

2.3.10.3 Direct reading electrical meters shall conform to IS 13779 / IEC - 1036, 687, 1286 suitable for single phase / three phase supply system in all respects. Accuracy of direct reading shall be class 0.2 of MFM and KWH meter for LVSB's,

2.3.10.4 Meter must have min two configurable digital I/O port and one Analog. And Password protection for meter is mandatory for unauthorized access.

2.3.10.5 All the meters shall be digital with menu drive selection and RJ45 port with MODBUS-TCP/IP connectivity to suit SCADA System with password protection. Suitable memory and software for logging the information along with real time metering information must be available. The meters must have required level of protection and sufficient number of auxiliary contacts. Meters shall be suitable for continuous operation between 0^0C and +50^0C.

2.3.10.6 Meters shall be flush mounted and shall be enclosed in dust tight housing. The housing shall be of steel or phenolic mould. Design and manufacture of meters shall ensure prevention of fogging of instrument glass. Selector switches shall be provided for ammeters and voltmeters used in three-phase system. This selector shall be of built-in type with meters.

2.3.10.7 Energy meters shall be two / three element, switch board mounting type suitable for unbalanced loads. In case of two incoming feeders, a summation C.T. shall be provided with the meter. Meters shall conform to BS: 37-1 or equivalent Indian Standard.

2.3.10.8 Ammeters shall normally be suitable for 5A secondary of current transformers.

2.3.10.9 Voltmeter circuits shall be provided with protection through MCB as required.

2.3.10.10 Wattmeter shall be of 3 phase Digital type and shall be provided with a maximum demand indicator with RJ45 port with MODBUS-TCP/IP connectivity, as required.

2.3.10.11 Three phase power factor meters shall be of Digital type with current and potential coils suitable for operation with current and potential transformers provided in the panel. Scale shall be calibrated for 50% lag - 100% - 50% lead readings with RJ45 port with MODBUS-TCP/IP connectivity.

2.3.10.12 Meters shall be of two / three element, integrating type. Meters shall conform to IEC 170 in all respects. Energy meters, kVA, and kVARH meters shall be provided with integrating registers. The registers shall be able to record energy consumption of 500 hours corresponding to maximum current at rated voltage and unity power factor. Meters shall be suitable for operation with current and potential transformers available in the panel and shall have connectivity through RJ45.

2.3.10.13 Square/rectangular pattern flush mounting meters complying with the requirements of the relevant Indian/International Standards shall only be used.

2.3.10.14 The display for single meters i.e., ammeter or voltmeters shall be 4.5 digits and integral meters shall be page display type as specified.

2.3.11 Multifunctional Meter

2.3.11.1 Multifunction Meter shall be of 3phase Digital type and shall be soft key arrangement to view all parameters randomly, it has LCD display to display all measurements like current, voltage, KW, MD, KWh, KVAh, PF, frequency, harmonics, THD, accumulated forward energy, accumulated reverse energy, Demand calculations, Demand synchronization, Demand interval etc**.,**

2.3.11.2 MFM shall be suitable to Communicate all parameters to SCADA through RJ45 Port with MODBUS TCP/IP for all Main Distribution and Sub distribution panels.

2.3.11.3 Square/rectangular pattern flush mounting meters complying with the requirements of the relevant Indian / International Standards shall only be used.

2.3.12 Relays

2.3.12.1 All control, interlock and alarm relays shall be mounted in positions readily accessible within the LVSBs. Unless otherwise Approved, these relays shall comply with the relevant requirements of IEC 60255.

2.3.12.2 Relays shall be Microprocessor based, of well proven design having auxiliary contacts and RJ45 connectivity, as required.

2.3.12.3 Protection relays shall be equipped to indicate cause of tripping. Relays shall be designed to make or break the maximum circuit current with which they are associated. Relay contacts shall be of silver or platinum alloy and shall be designed to withstand repeated operation without damage. Relays shall be of draw out type to facilitate testing and maintenance. Draw out case shall be dust tight. Relays shall be capable of disconnecting faulty section of network without causing interruption to remaining sections. Analysis of setting shall be made considering relay errors, pickup and overshoot errors and shall be submitted to Engineer for approval. All relays shall be hand reset type from front of panel.

2.3.12.4 The relays shall be duly compensated against fluctuation in ambient temperature and frequency and shall have single phase prevention feature.

2.3.12.5 Over current relays shall be of digital microprocessor type with inverse definite minimum time lag characteristics. Relays shall be provided with adjustable current and time settings. Setting for current shall be 20 to 200% in steps of 5%. The IDMT relay shall have time lag (delay) of 0 to 3 seconds. The time setting multiplier shall be

adjustable from 0.1 to unity. Over current relays shall be fitted with suitable tripping device with trip coil being suitable for operation on 5amps.

2.3.12.6 Earth fault relays shall be same as over current relay, except that the current setting shall be 10% to 40% in steps of 5% with suitable alarm provision on before tripping

2.3.12.7 Under voltage relays shall be of digital microprocessor type & shall have inverse limit operation characteristic with pickup voltage range of 40to95%of the rated voltage with suitable alarm provision on before tripping.

2.3.12.8 Relays shall all be contained in dust-proof cases suitable for flush mounting with the doors of dedicated and segregated relays compartments within the LVSBs.

2.3.12.9 All metal cases and frames of relays shall be earthed except where they must be insulated for special requirements.

2.3.12.10 The relays shall be of the approved type, construction and finish. Relay equipment shall be of the withdrawable pattern and shall have positive means for retention in the service position.

2.3.12.11 All relays completing either a tripping circuit or the circuit to a coil of an auxiliary tripping relay shall be provided with Approved operation indicators which, wherever possible, shall be of the mechanically operated manually reset type.

2.3.12.12 All AC relays shall operate satisfactorily when their AC supply voltage varies between 70 % and 120 % of its rated value, unless stated otherwise.

2.3.12.13 All relays shall be suitably marked for purposes of identification with the following information:

a) Function of relay,
b) Device number, and
c) Voltage and phase colour of the supply (where applicable).

2.3.12.14 All interposing relays used for remote supervisory control shall have surge suppression device across each coil.

2.3.12.15 Contacts for remote alarms and indication shall be volt-free.

2.3.12.16 Relays shall not be affected by mechanical shock or vibration, or by external magnetic fields, consistent with the place or method of mounting.

2.3.12.17 Operation indicators shall be fitted to tripping relays, under voltage (U/V) relays and such other relays or relay elements to enable the type of fault condition to be identified. The indicator shall be capable of being reset without the relay case being opened. The under voltage relays shall be of three- phase type and have a voltage setting range of 40% to 95% of nominal voltage.

2.3.12.18 Except when the requirements of auto-control circuits do not permit, all protection relay switch initiate tripping (excluding tripping relays) shall have not less than two independent pairs of contacts, of which one shall operate the tripping relay/circuit directly without the interposition of auxiliary contactors and reinforcing contactors.

2.3.12.19 In order to minimize the effects of electrolysis, operation indicator coils and DC relay operating coils shall be so placed in the circuit that they are not connected to the positive pole of the battery except where such connections are interrupted by contacts which are normally open.

2.3.12.20 All contacts for control and auxiliary equipment shall be adequately rated for their duty and subjected to approval by the Engineer.

2.3.12.21 Adjustable time delay U/V relays shall be selected such that the relays will not operate due to starting of a high rating motor at the LV side.

2.3.12.22 Relays measuring the current quantities in series with the CTs shall be fitted with contacts which shall short circuit the associated CTs on withdrawal of the relays.

2.3.12.23 For triple pole VIDMT or EIDMT O/C relays, three single phase units in one horizontal plane and housed in a common casing shall be provided.

2.3.13 Interlock and Padlocking Facilities

2.3.13.1 Mechanical key interlocks shall be provided and shall be so designed as to avoid mal-operation at the point of manual application. The scheme shall be such that attempts to remove a captive key shall not result in tripping or opening of the device.

2.3.13.2 Electrical interlocks on withdrawable equipment shall be so arranged that if the equipment's are withdrawn, the complete operation of the withdrawn equipment shall be independent of the remote interlocking contacts. In addition, interlocks shall not be defeated leading to damages or unsafe operations of LVSBs due to the withdrawing of equipment.

2.3.13.3 Locking facilities shall be provided where appropriate for switches and isolators in order that they may be locked in the open position. Switchgear cubicle access doors shall be equipped with integral type locks, preferably incorporated in the handles of the equipment.

2.3.13.4 Where locking facilities are of the integral barrel type, the key for each lock shall be unique to the associated lock unless otherwise specified.

2.3.13.5 Two keys shall be provided for every lock supplied. The keys shall be fitted with rings with identification labels, and wooden cabinets with glazed front- opening doors shall be provided. The cabinets shall be adequate in size and equipped with hooks to house all keys when not in use, and shall be mounted in positions to be decided.

2.3.14 Emergency Push Button (EPB)

2.3.14.1 Emergency lock and key type push buttons shall be installed at or near all exit doors of the LV Switch rooms to de-energize the LVSB in the event of an emergency. The EPB shall be button type with flat surface protection guard ring and pressed-in design with key reset so that accidental triggering and vandalism shall be avoided as far as possible. Transparent hinged cover shall be provided in front. Unless otherwise specified on the Drawings, the EPB shall be mounted at 1300mm above finish floor level. The button design and the installation details shall be submitted for approval.

2.3.14.2 The tripping of the ACB(s) shall be via local hard wiring control and interface with the EPBs. Signal(s) shall also be generated from the control circuit(s) of the LVSB to inter trip the HV circuit breaker(s) upstream of the corresponding LVSB and the switchboard interconnected section ACB.

2.3.15 Equipment for SCADA/BMS Interface

2.3.15.1 Volt-free contacts provided for SCADA Remote monitoring interface shall comprise a pair of terminals operated directly by the equipment but electrically separated such that no potential derived from the equipment appears at the terminals. The terminals shall be wired from contaminates or required isolation shall be achieved by equipment panel manufacture to provide the interface terminals for SCADA interface. All terminals shall be marked as per metro standard for proper identification. Panel manufactures shall provide necessary signal monitoring interface provision for SCADA as per SCADA tender specification. No such virtual signals or change in contacts shall be allowed for SCADA interface. respective equipment Volt-free contacts to the SCADA interface terminal board. Separate cable

2.3.15.2 For the equipment to be controlled by the SCADA, the panel manufacture shall provide remote control interface terminal with proper marking and with due isolation from VFC interface terminal. SCADA PLC interface for control command shall be pulse type close contacts for single command output / double command output or a variable voltage/current (i.e. 0v – 10V or 4mA – 20 mA) for analog output command. It is the responsible of panel manufactures to provide necessary interface detail during SCADA commissioning or supervise as appropriate during installation and testing of SCADA system. There shall be one interface for control open and one for control close operations. The Contractor shall provide appropriate equipment to sense and latch the remote-control signal for performing the open/close control function. The SCADA digital output (DO) & analog output (AO) signal shall be as stipulated.

2.3.15.3 Contacts shall be rated to adequately make and break and carry continuously not less than 5 A at 250 V AC or 2 A at 110 VDC.

2.3.15.4 Volt-free contacts for sequence of event (SOE) alarms shall firmly close and seat in position once activated. The contacts shall not bounce or vibrate due to internal or external causes.

2.3.15.5 All communicable equipment's shall be provided with interface provision for SCADA using RJ45 communication port over standard Modbus TCP/IP protocol communication interface. Required data point as per SCADA requirement shall be configured in respective controller or equipment by panel manufactures as required with necessary hardware and software for above said serial link communication. It is the responsible of panel manufactures to provide necessary interface detail such as data point register address during SCADA commissioning or supervise as appropriate during installation and testing of SCADA system.

2.3.15.6 Marshaling Unit Single location interface for different LV components of main distribution panel (DB100, DB200) shall be provided through marshaling chamber for SCADA interface. All interface terminal and ports for SCADA shall be wired up to the marshaling chamber. Necessary Marking and ferruling shall be provided for individual termination. Control command interface and other terminals having potential should have due separation from VFC interface terminals. Control and signal cable wiring from different relays, sensors, transducer, controller and contactor releases shall be through separate wiring contaminate to avoid fault current or external magnetic/ electric interface. All communicable breaker,

controller or meters with provision of standard protocol (MODBUS -TCP/IP) communication shall be individually wired upto the marshalling box interface terminal. Necessary multi dropping and single point interface provision shall be done through suitable short link. Not more than 10 communicable devices using standard protocol communication shall be looped for single point interface to meet performance requirement. Marshaling chamber should have provided with necessary mounting arrangement or space provision for SCADA remote IO module/ PLC equipment along with its associated interface equipment and power supply unit. Panel manufactures shall provide the required termination and interface detail for SCADA work. In case of requirement of supervision and guidance during SCADA commissioning same shall be inclusive to the panel manufacture's scope of work. Marshaling box shall compile with EMC (Electro Magnetic Compliance) and protected from any electrical or magnetic interface. Required protection against of any SCADA or Panel components must be inclusive to respective contractor's scope of work. Any specific interface requirement not specified here with shall be wired up to the marshaling chamber interface terminal. SCADA interface point should only confine to marshaling box.

2.3.15.7 For All the panel other than DB 100, 200 and DG syn panel with 7" LCD display, HMI must be provided with color touch display. In that all the I/C and O/G of all the breaker, I/C Breaker three phase currents, un balanced current, temperature of Busbar, I/C and O/G chamber and Meter data must be configured.

2.3.16 Wiring Diagrams

Every compartment of the LVSBs shall be provided with a wiring diagram suitably treated to prevent deterioration from dirt or age. The diagrams shall be drawn as if viewed from the point of access to the enclosure and shall be securely fastened to the inside of the access door of that compartment.

2.3.17 Indicating Lamps

2.3.17.1 The Indicating Lamp shall be 240 V AC Type heavy duty LED lamps. All indicating lamps shall be suitably rated so that the indication is clearly visible from the side and front at a distance of not less than 3 m in a room having an average vertical illumination of 150 lux.

2.3.17.2 Lamps shall be well ventilated and the design shall permit replacement of lamp lens and bulbs from the front of the unit.

2.3.17.3 The colours of indicating lamps for red phase, yellow phase, blue phase, ACB on, ACB off and ACB trip shall be red, yellow, blue, red, green and amber respectively.

2.3.17.4 All the MCC panel make controls screen panel shall have relevant tank/Sump/Level indication required in respect panel.

2.3.18 Control Switches

2.3.18.1 Circuit breakers shall be fitted with control switches of the pistol grip type, with spring return to the neutral position, and with an interlock to prevent repetitive closing without moving first to the trip position.

2.3.18.2 Switches for other control selection and other purposes shall have spade type handles.

2.3.18.3 Control switches shall be fitted with facilities for padlocking to prevent unauthorized operations.

2.3.18.4 Selector switches shall be provided such that voltmeters can read voltages between phase and phase and between phase and neutral, and that ammeters can read currents between phases and between phase and neutral.

2.3.18.5 Operating Coils all must be Universal. AC and DC comma Coil.

2.3.18.6 All fine wire operating coils and wire wound resistors shall be vacuum impregnated with an insulating varnish.

2.3.19 Auxiliary Switches and Contacts

2.3.19.1 Auxiliary switches provided for indication, protection, metering, control, interlocking and supervisory purposes shall be readily accessible at the front of the LVSBs. Adequate secondary contacts shall be included to enable the auxiliary switch to be wired to the fixed portion of the equipment.

2.3.19.2 For each control compartment, spare auxiliary contacts with a minimum of two NO and two NC contacts shall be provided, and wired to suitably identified spare terminals.

2.3.19.3 Auxiliary contacts for all applications shall be rated at 240 V AC or 110 V DC with contact rating of at least 6 A AC or DC and operating life of at least one million on-load operations at 0.4 power factor inductive load.

2.3.20 Control Supply

2.3.20.1 240V control AC supply will be available from the station UPS. DP MCB protection shall be provided at incoming. Separate control bus of suitable rating made of copper shall be provided throughout the panel length, and the control bus should be accessible from the front of the panel. Control voltage taping for different feeder shall be done with proper clamp. 240V voltage sensing relay with volt free contacts shall be provided for sensing the control supply for local and remote indication to SCADA. The control circuit shall be separated from other auxiliary circuits, i.e. indicating circuit, heater and lighting circuits, with dedicated circuit protective devices.

2.3.21 Air Circuit Breakers

2.3.21.1 General

All ACBs shall be **compact type design** and comply with **IEC 60947-1& 2** and shall meet the following requirements:

All the ACB's shall have the following minimum feature.

a) Number of poles: The incomer ACBs and bus-section ACB shall be four-pole type. For balance ACBs the number of poles shall be as shown on the BOQ/drawings
b) Rated insulation voltage: 1000 VAC as per IEC 60947-1 &2,
c) Rated operational Voltage is 690V.
d) Rated frequency: 50Hz,
e) Rated uninterrupted current: as shown on Drawings, BOQ.

f) Rated ambient temperature:45 ^{0}C,

g) ACB's must have high Electrical life of 15000 operations up to 2000 A breaker, and above is 5000.

h) Rated short-circuit making capacity: shall be at least 2.1 times of ultimate short ckt breaking capacity at 0.25 power factor,

i) Rated ultimate short-circuit breaking capacity (Icu): min 65 kA and based on actual fault level,

j) Utilization category: B,

k) Rated short-time withstands current (Icw): 65kA for 1 second (minimum) as per SLD/BOQ.

l) Rated service short-circuits breaking capacity (Ics): 100% of ultimate short circuit (Icu), and withstand short circuit (Icw) (Icu=Ics=Icw)

m) All ACBs shall be electrically operated and withdrawable type.

n) All ACBs shall preferably be of single group/family. To optimize requirement and effective spares management.

o) All ACBs shall be of the air brake horizontal withdrawable pattern complete with interlock stop relevant withdrawal when the breaker is closed. Electrical connection between the breaker and "Switchboard" shall be of plug and socket type with automatic screening shutters which will shield the fixed terminals in the "Switchboard" in a manner such that no access can be made to the fixed terminals when the breaker is withdrawn. In order to prevent unauthorized operation, the withdrawable air circuit breakers shall be provided with padlock facilities to secure them in their CONNECTED, TEST and ISOLATED positions.

p) ACB shall have microprocessor-based protection releases for type of faults, as required, and shall have an LCD graphic touch display to show bar graph, true RMS current, in all the three phases and the highest current among three phases including unbalanced current.

q) Breaker must have inbuilt protection of ANSI, 49, 51, 51TD, 50, 51N, 51N TD, 51G, Zone Selectivity 68, under voltage – 27, Over Voltage 59, Residual Current 64.

r) Breaker must have 20 trip history along with time stampings and 100 Event histories.

s) All the ACB must display V, A, Hz, KW, KVA, PF, in all three individual phases and total with class 1 accuracy metering as an inbuilt feature.

t) The release shall have zone selective interlocking

u) All the ACB must be able to communicate with Bluetooth and password protection.

v) Breaker must display the number of operation counter itself.

w) Breaker must display contact wear.

x) The Microprocessor release should be inbuilt RJ45 port with communication protocol of Modbus TCP/IP.

y) The overload and short circuit characteristics should be front adjustable.

z) All the ACB must display the temperature.

aa) ACB should be mechanically robust in construction.

bb) Fire resistant transparent covers shall be provided over ACB's to achieve IP-54 protection.

cc) ACB must have the provision of two number LOTO locks.

dd) Safety shutter for Touch panel.

2.3.22 Operating Mechanisms

a) All ACBs shall be provided with hand charged and motor charged spring closing mechanism rated at 240V Universal coil.

b) All operating mechanisms shall have mechanical 'ON' and 'OFF 'indicators and a manual trip device fitted with means for locking. The spring charging motor shall be suitable for operation with in a voltage range of 70 % to 120% of the rated control supply voltage.

c) The operating mechanism shall be trip-free.

d) All EDO ACB should have ready to close contact for electrical indication at panel door

2.3.23 Shunt Trip Coils

A shunt trip coil rated at 240-volt AC shall be provided. The shunt trip coil shall be suitable for operation within a voltage range of 70% to 120% of the rated A.C power supply voltage.

2.3.24 Interlocks and Test Operation Facilities

All ACBs shall be provided with interlocks to ensure that:

a) The ACB cannot be plugged in or isolated while it is closed,

b) the ACB cannot be closed until it is fully plugged in or completely isolated,

c) the ACB cannot be closed in the service position without completing in the auxiliary circuits between the fixed and moving portions, with hand charged and motor charged spring mechanisms the springs cannot be discharged until they have been fully charged and until the means for charging has been removed or disconnected, Facilities shall be provided for testing the ACB operation when in the isolated and withdrawn positions by the normal means as in service. Where control circuits are provided and interlock circuits are broken via plugs on withdrawal of the ACB, A minimum of one jumper lead and plug assembly of each size and type shall be provided to facilitate testing in the withdrawn position.

d) The racking handle shall be provided/ stored on each ACB in such a manner as to be accessible without defeating the door interlock, racking shutter should open only when ACB is OFF.

e) All ACB's should be provided with mechanical counter and door interlock facility.

f) The neutral shall be rated for 100% as per SLD.

2.3.25 Safety Shutters

A set of shutters with padlocking facilities shall be provided to cover each three-phase group of stationary isolating contacts. The shutters shall be independent and operated automatically by a positive drive from the ACB withdrawal mechanism. LOTO Locks must be providing for ACB Fixed part and Moving part.

2.3.26 Control Switch for Air Circuit Breakers

The handles of control switches for air circuit breakers shall turn clockwise for closing and anti - clockwise for tripping and shall be of the pistol grip type. The control switch shall be clearly labelled as CIRCUIT BREAKER OPEN – NEUTRAL - CLOSE, with spring return to the neutral position. Mechanical interlock shall be fitted to prevent repetitive closing without moving first to the trip position, and shall be capable of padlocking in the neutral or trip position.

Air Circuit breakers shall have panel space and be equipped with at least but not limited to the devices as detailed below:

(a) All Panel Incomer's ACB's

1) For Main incomer from transformer ANSI-81T, 64R- Restricted Earth Fault Relay and a Standby Earth Fault Relay as specified for the interface with high voltage switchgear.
2) Four pole horizontal draw - out automatic air circuit breaker with normal current rating as shown on the Drawings and provided with:
3) Hand charged and 240V AC motor charged spring closing mechanism complete with anti-pumping relay, discharge resistor, auxiliary switch, etc.
4) 240 V A.C shunt-trip coil shall be operable, within operational voltage range of 70% to 120% of rated voltage,
5) ACB Shall have spare auxiliary switches to be equally divided between normally open and normally closed. At least 6 spare pairs of N.O. and N.C. volt free contacts shall be provided.
6) ACB shall be equipped with release unit with selective over current (long time, short time & instantaneous) & earth fault protection, measurement of electrical parameters as mentioned in BOQ and with communication capability with SCADA system.
7) Control relays and wiring for automatic changeover interlocking and other breaker operation as shown on the Drawings.
8) Voltage sensing relay and associated relays for automatic changeover and interlocking operation as detailed on the Drawings.
9) Electrical interlock for the two incoming circuit breakers and interconnector bus- section circuit breaker to prevent paralleling of different power supply sources at any one time as shown on the Drawings.
10) Two-way inter-tripping relays shall be provided with the associated HV feeder circuit breaker by interfacing with the Power Supply Contractor.
11) Local/auto control selector switch, lock able in all positions. The automatic control shall be defeated when the selector switch is put at 'Local' position.
12) Circuit breaker close/trip control switch, pistol grip type.

13) Indicating lamps for on, off, tripped on fault and trip supply healthy, with all necessary push buttons, panel wiring, bus wiring, terminals etc.

14) Power and control cable terminations with un-drilled and plates for power cables and multi – core cables.

15) Circuit labels, one on the front of the panel and one on the rear of the panel suitably engraved.

16) ACB must display Power quality parameters like Harmonics, Voltage Sag's and swell.

17) Remote indication and alarm facilities.

Control circuits and relays with signal cables wired back to terminal block to initiate remote alarms and indicators as follows:

i) Circuit-breaker open,
ii) Circuit-breaker closed,
iii) Circuit breaker is ready to close.
iv) Circuit-breaker tripped on fault, and
v) Switch position of local/auto control selector switch
vi) Set of terminals wired to provide for connection to the following:
vii) Automatic changeover and interlocking as shown on the Drawings, and
viii) Operation of Emergency Push Buttons.

Signal cables wired to the terminal block for remote monitoring to SCADA.

(b) Outgoing Feeder and Bus Couplers Air Circuit Breakers

1) Triple pole horizontal draw-out automatic air circuit breaker having normal current rating as shown on the Drawings and provided with:
   i) Hand charged and 240 V AC motor charged spring closing mechanism complete with anti-pumping relay, discharge resistor, auxiliary switches, etc.,
   ii) 240-volt A.C shunt-trip coil, within operational range of 70% to 120% of rated voltages,
   iii) Maximum number of circuit-breaker auxiliary switches, spare auxiliary switches to be equally divided between normally open and normally closed. At least 4 spare pairs of N.O. and N.C. volt free contacts shall be provided,
   iv) ACB shall be equipped with release unit with selective over current (long time, short time & instantaneous) & earth fault protection (ANSI- 49, 51, 51TD,50,51N, 51N-TD, 51G, and 68 measurement of electrical parameters as mentioned in BOQ and with communication capability with SCADA/BMS system.
2) Control relays and wiring as required for breaker operations as shown on the Working Drawings.
3) One single pole lock-out hand reset fault trip for circuit-breaker tripping, and local indication.
4) Local/remote control selector switch, lockable in all positions. The remote BMS control shall be defeated when the selector switch is put at 'Local' position.

5) Circuit breaker with close/trip control switch and of pistol grip type.
6) Anti-condensation heater(s) complete with humidistat, MCB and isolating switch.
7) Indicating lamps for on, off, tripped on fault and trip supply healthy with all necessary push buttons, panel wiring, bus wiring, terminals, fuses, etc.
8) Power and control cable terminals with undrilled gland plates for outgoing power cables and multi-core cables.
9) Circuit labels, one on the front of the panel and one on the rear of the panel suitably engraved.
10) Remote indication and alarm facilities:
    i) Circuit-breaker open,
    ii) Circuit-breaker closed,
    iii) Circuit breaker is ready to close.
    iv) Circuit-breaker tripped on fault, and
    v) Switch position of local/remote control selector switch.
11) Set of terminals wired to provide for remote close and trip.

2.3.27 Moulded Case Circuit Breakers (Double Break)

2.3.27.1 **General**

2.3.27.2 MCCBs shall comply with and be type-tested to IEC 60947-1 & 2. Each incoming MCCB shall be of drawable type and outgoing MCCB shall be of plug in type, as specified in the BOQ and have all the mechanical and live parts completely enclosed in an insulated moulded case. With drawable pattern circuit breakers shall be designed that their electrical equipment can be safely disconnected from or connected to the main circuit whilst the circuits are live.

2.3.27.3 MCCBs shall meet the following requirements:

a) Number of poles: double-pole, triple-pole or four poles as specified on the Drawings,
b) Rated operational voltage: 240 / 415 VAC,
c) Rated insulation voltage: 1000 VAC,
d) Rated service voltage is 690 V.
e) Rated uninterrupted current (In): as shown on the Drawings, but after taking into account the installation conditions and temperature deration.
f) Rated frequency: 50Hz,
g) Rated short-circuit making capacity (Icm): shall be at least 2.1 times of ultimate short ckt breaking capacity at 0.25 power factor.
h) Rated ultimate short-circuit breaking capacity (Icu): 35/50/65 kA(min),
i) Rated service short-circuits breaking capacity(Ics): 35/50/65 kA Further, Ics must be equal to 100% Icu for the selected breaker,
j) Utilization category: up-to 200 Amps is “A” or from 200Amps and above is “B” as appropriate.
k) Degree of protection**:** IP 3X to IEC 60529 Standard
l) All the MCCB must have inbuilt thermal memory.
m) Rated ambient temperature: 45°C.
n) All Incomer MCCB is Electrically operated with drawable type.

o) All the Outgoing MCCB with Plug in type.

p) MCCB shall be suitable for isolation as per Annexure 7.1.2 of IEC 60947 – 2 standards.

q) All the MCCB are double breaking type.

r) It must be with self-isolation type.

s) All MCCB's should have front adjustable microprocessor-based releases with adjustment in the range of 40 – 100% for nominal overloads and 1 – 10 In of rated current for selective short circuit faults with time delay. MCCB's for network/Feeder Protection shall have releases with earth Fault Protection features, wherever and as indicated in Bill of quantities or drawings.

t) The trip unit shall be easily replaceable in the same MCCB without changing the MCCB.

u) Impulse Withstand Voltage -8KV

v) Mechanical Strength

w) Rated service short-circuits breaking capacity (Ics): 100% of ultimate short circuit (Icu), O – t - CO – t - CO type of Duty i.e(Ics=Icu).

x) Selection of ACB, MCCB and MCB shall be of same make. Total Discrimination up to the design fault level. For this OEM must give the supporting documents like catalog or test certificate.

y) Up-to the Ics value of Downstream Breakers must be available between the various elements of switchgear (ACB, MCCB, MCB etc) selected. Supplier must provide test certificates from acceptable, accredited and reputed laboratories to prove the same, if so desired by Engineer. In view of Standardization and Uniformity, mixing of two series of switchgear (even from the same manufacturer) for either MCCB or ACB will not be permitted. In case higher frame sizes (than those specified in the BOQ) is required to be provided to achieve the above requirement, due to selection of a particular make, the same shall be provided at no extra cost if other makes are able to achieve the same with the specified frame size.

z) Discrimination chart must be submitted by switchgear OEM approval along with its catalog.

2.3.27.4 The operating mechanism of MCCB's shall be independent of the operating speed of the over centre toggle and the MCCB shall be of current limiting type and comprise of Quick make and Quick break switching. Contacts shall be non-welding type. The operating mechanism shall be trip-free and provided with mechanical "ON", "OFF" and "TRIPPED" indicator. The MCCB shall be designed for both vertical and horizontal mounting, without any adverse effect on electrical performance.

2.3.27.5 The time delay on overload tripping shall be inversely proportional to the overcurrent up to a threshold value of min six times the rated current at the rated working temperature.

2.3.27.6 All MCCB's shall be arranged for padlocking in OFF positions with lock provided. A shunt trip coil shall be provided to facilitate automatic tripping and local manual tripping. The manual trip device shall be fitted with the means of padlocking. The shunt trip coil shall be suitable for operation within a voltage range of 70% to 110% of the rated AC power supply voltage.

2.3.27.7 Handle position shall give positive indication of 'ON' or 'TRIPPED', thus qualifying to Disconnection as per IEC60947, indicating true position of all the contacts.

2.3.27.8 In case of four Poles MCCB, neutral shall be defined and capable of offering protection up to full rating with possibility of adjustment at site in the neutral setting.

2.3.27.9 MCCB's shall have common field fit table auxiliaries for the entire range and above 250 A the accessories like spreaders and phase barriers should be the integral part of the MCCB's.

2.3.27.10 Remote closing and tripping coil should be of continuous duty cycle.

2.3.27.11 MCCB's shall have an electrical endurance of the order of 10000 operation cycles.

2.3.27.12 Electronic trip units shall comply with the requirements as specified in Appendix F (EMC / EMI Compatibility) of IEC 60947-2

2.3.27.13 MCCB's to be provided in LV Main Switch board shall be stored energy type motorized and Suitable for Remote Closing by SCADA.

2.3.27.14 All the MCCB must have trip indication to identify the type of fault.

2.3.27.15 MCCB must has to communicate with RJ45 port through V,I, KW, KVA and number of operation with LCD with touch display on the breaker or external.

2.3.28 Panel MCCB Incomers

2.3.28.1 Must have inbuilt protection of ANSI, 49, 51, 51TD, 50, 51N, 51N TD, 51G, Zone Selectivity 68, under voltage – 27, Over Voltage 59, Residual Current 64.

2.3.28.2 Communication options to remotely read and set parameters for the protection functions, transmission of all the calculated indicators and measurements

2.3.28.3 Provision for measurement of V, A, W, VAR, VA, Wh, VARh, Hz, power factor, Harmonics, interrupted currents and etc with class 1 accuracy. and differentiated fault indications, Contact wear and tear indications

2.3.28.4 Last few trappings and event/operation histories and time stamping with facility for consulting the history file, maintenance indicator register, Wear of Contacts and Signaling (ON/OFF and Trip) cause of tripping and alarms etc.

2.3.28.5 NO/NC/Trip and Local/remote Control contacts for interlocks and indications

2.3.28.6 Must be provided with minimum 3 NO + 3 NC contacts and there should be provision to add min.2NO+2 NC Auxiliary contacts.

2.3.28.7 LED indication lamp for the following, Feeder ON, OFF, Trip, Lamp Test, Ready to close, Emergency Stop, Mechanical Lock, Control supply metering, Spring charge, Fault, Local/remote mode, etc. with 0.5 A MCB Protection.

2.3.28.8 Panel temperature must be monitored in Busbars of RYB terminals, and incoming RYB terminals. The temperature must be displayed in respective I/C and OG Breaker's Once temperature exceeds 50'C it must give the Alarm and 75'C it must give the signal to BMS and SCADA.

2.3.29 MCCB Outgoing's

2.3.29.1 Must have inbuilt protection of ANSI, 49, 51, 51TD, 50, 51N, 51N TD, 51G

2.3.30.1 Communication options to remotely read and set parameters for the protection functions, transmission of all the calculated indicators and measurements

2.3.29.2 Provision for measurement of three phase current, Neutral Current, unbalanced current, number of operations with RJ45 port with Modbus TCP/IP communication

2.3.29.3 Last few trappings and event/operation histories and time stamping with facility for consulting the history file, maintenance indicator register, Wear of Contacts and Signaling (ON/OFF and Trip) cause of tripping and alarms etc.

2.3.29.4 NO/NC/Trip and Local/remote Control contacts for interlocks and indications

2.3.29.5 Must be provided with minimum 3 NO + 3 NC contacts and there should be provision to add min.2NO+2 NC Auxiliary contacts.

2.3.29.6 LED indication lamp for the following, Feeder ON, OFF, Trip, Lamp Test, Ready to close, Emergency Stop, Mechanical Lock, Control supply metering, Spring charge, Fault, Local/remote mode, etc. with 0.5 A MCB Protection.

2.3.28.9 Panel temperature must be monitored in Busbars of RYB terminals, and incoming RYB terminals. The temperature must be displayed in respective I/C and OG Breaker's Once temperature exceeds 50'C it must give the Alarm and 75'C it must give the signal to BMS and SCADA.

2.3.30 Automatic Transfer Switches

2.3.30.2 Automatic load transfer switches shall be composed of paired ACBs or MCCBs. MCCB used in Automatic Load Transfer switches shall be used as specified in Clause 2.3.27 above and ACB used for this purpose shall be used as specified in Section 2.0 of Technical specifications.

2.3.30.3 Paired ACBs or MCCBs (as specified above) shall be provided with motorized mechanisms for "ON/ OFF" operation.

2.3.30.4 Each automatic load transfer switch shall be equipped with, but not be limited to, the following:

a) Illuminated indicator for "Normal Supply On" and "Standby Supply On" to be provided at the front cover of the compartment housing the changeover switches.

b) Transfer mechanism to facilitate automatic / manual changeover from the normal source to the standby source.

c) Automatic/manual changeover selector switch. It shall be possible to manually operate the circuit breakers in the event of absence of control voltage.

d) ASCS / ATS should have electrical interlocking along with mechanical interlocking through base plate to ensure that two MCCB`s shall not be ON simultaneously.

e) Interlocking facility to ensure that normal breaker tripped on fault will not cause the standby breaker to close or vice versa, unless the breakers are reset manually.

f) A test switch to simulate mains power failure and indicate the changeover sequence to allow on-load testing.

g) Auxiliary relays and contacts to facilitate main power source failure for routine testing of the automatic changeover operation.

h) 2 nos. each NO and NC volt free dry contacts shall be provided for each changeover circuit breaker unit.

i) The Changeover function shall work without Auxiliary Power Supply with Fail Safe operation.

j) All indications for all the operations viz., ON, OFF, TRIP. On panel as well as with remote operation.

2.3.30.5 The changeover system between the normal and standby sources shall be as follows:

a) 3 phase sensing circuits with adjustable time delay facility in the range of 0 to 15 seconds shall be provided to monitor the voltage condition of the normal and standby source.

b) Failure of one or more phases of normal main supply or a reduction of voltage to a value of 90 % to 70 % (adjustable) of the nominal value shall initiate the timing device. If the failure persists at the expiry of this preset time delay, the changeover action will be affected provided that the voltage of the standby source reaches 90 % of the nominal value.

c) Upon restoration of the normal power supply, which has been determined stable after a time delay, the changeover switch shall automatically be restored to the normal supply. It shall also be able to switch the load back to the normal supply under manual control.

2.3.31 Miniature Circuit Breakers (MCB)

2.3.31.1 MCBs shall comply with and be type-tested to IEC 60898 or EN 60898. IEC 60947

2.3.31.2 MCBs shall meet the following requirements:

a) Number of poles: single-pole, double-pole, triple-pole or four-pole as specified on the Drawings,

b) Protection against external influences: Enclosed-type,

c) Method of connection: Bolted type,

d) Rated operational voltage: 240 / 415 V AC,

e) Rated current: 0.5 A, 1 A, 2 A, 4 A, 6 A, 10 A, 16 A, 20 A, 25 A, 32 A, 40 A, 63 A, as shown on the Drawings. Above 63A, MCCB as specified above must be used.

f) Rated frequency: 50 Hz,

g) Range of instantaneous tripping current: MCB’s shall be current limiting

h) Type Class 3 with range of instantaneous tripping current B, C or D type as appropriate or as specified,

i) Rated short-circuit breaking capacity: not less than 10 kA (M3) unless otherwise specified,

j) I2t characteristic: suitable for load and circuit being protected,

k) Degree of protection: IP-20 for MCB`s

l) Reference ambient temperature: 45°C.

m) MCB's shall have minimum power loss (Watts) per pole as per the IEC and should be proven by published value by manufacturer

Electrical endurance life is 20000 operation's

2.3.31.3 The load handling contacts shall be silver/tungsten and the contacts and operating mechanism shall be designed so as to give a wiping action both at make and break. The breaker operating mechanism shall be of trip-free type. The breaker operating dolly shall be clearly indicated for the "ON" and "OFF" positions. It should be of Quick make and Quick break type.

2.3.31.4 Circuit protection against overload and short-circuit conditions shall be provided by means of thermal-magnetic device. Double-pole, triple-pole, and four pole MCBs shall be integral units and interlocked internally so that an overcurrent through any pole shall trip all the poles of the MCB simultaneously. An assembly of two or three or four single-pole units mechanically strapped together is not acceptable.

2.3.31.5 Housing shall be heat resistant and having a high impact strength. All DP, TP, TPN and FP circuit breaker shall have a common trip bar and should be mechanically coupled through a pin. It shall have an electrical endurance of the order of 10000 operation cycle for current rating of up to 50A.

2.3.32 Residual Current breaker with Overload protection

2.3.32.1 RCBO's shall be double pole or four-pole current-operated, housed in a totally enclosed moulded case, manufactured and tested in compliance with IEC 61008 or EN61008.

2.3.32.2 RCBO's (Icu=Ics=Icn=10 KA) shall meet the following requirements:

Number of poles: double-pole or four-pole as specified on the Drawings,

a) All the RCBO's are A type only unless otherwise specified.
b) Rated current (In): as shown on the Drawings,
c) Rated residual operating current: 30 mA or 100 mA or 300 mA as shown on the drawings or as per approval of the Engineer.
d) Rated voltage: 240 / 415 VAC,
e) Rated frequency: 50Hz,
f) Rated short-circuit capacity: not less than 1.5 kA unless otherwise specified,
g) Operating characteristics in case of residual currents with DC components: as specified,
h) Method of mounting: distribution board type,
i) Method of connection: connection shall be made with proper size of thimbles and number ferruling for circuit identification,
j) I^2t characteristic: suitable for equipment and circuit being protected,
k) Degree of protection: IP 3X to IEC 60529 or EN 60529, and
l) Reference ambient temperature:45°C.
m) All the Two pole two module RCBO's must be two modules (Icn=Ics=Ics=10KA)

2.3.32.3 The tripping mechanism shall be of trip-free so that the unit cannot be held closed against an earth fault. Tripping devices utilizing electronic amplifiers or rectifiers are not acceptable.

2.3.32.4 Provision shall be made for testing the automatic earth - leakage tripping by an integral test device. A device shall be fitted for prevention against reclosing after the device has tripped on earth leakage.

2.3.33 MPCB (Motor protection circuit breaker)

2.3.33.1 Motor circuit breakers shall comply with the general recommendations of standard IEC 60947 -1,-2 and -4-1.

2.3.33.2 The devices will be in utilization category A, conforming to IEC 60947-2 and AC3 conforming to IEC 60947-4-1.

- Rated operational voltage of 690V AC (50/60 Hz), 600V
- Rated insulation voltage of 690V AC (50/60 Hz), 600V
- Isolation conforming to standard IEC 60947-2,
- Rated impulse withstand voltage (Uimp) of 6 kV.

2.3.33.3 MPCB shall meet following requirement: -

2.3.33.4 Mounting: The motor circuit breakers will be designed to be mounted vertically or horizontally without derating. Power supply will be from the top or from the bottom.

2.3.33.5 Contacts: In order to ensure maximum safety, the contacts will be isolated from other functions such as the operating mechanism, casing, releases, auxiliaries, etc, by high performance thermoplastic chambers.

2.3.33.6 Operating mechanism: The operating mechanism of the motor circuit breakers must have snap action opening and closing with free tripping of the control devices. All the poles will close, open, and trip simultaneously.

2.3.33.7 Button: The motor circuit breakers will be actuated by a rotary operator clearly indicating the position ON (I), OFF (O), Trip

2.3.33.8 Isolation: In order to ensure isolation with clearly visible breaking conforming to standard IEC 60947-2 paragraph 7.2.7:

- The mechanism will be designated so that the different types of operator will only be in position (O) if the main contacts are physically separated,
- In position (O) the operating devices will indicate the isolated position.

  Isolation is enhanced by the double break of the main circuit.

2.3.33.9 Padlocking: The motor circuit breakers will accept a padlocking device in the “isolated” position.

2.3.33.10 Trip: The motor circuit breakers will be equipped with a “PUSH TO TRIP” device on the front enabling the correct operation of the mechanism and poles opening to be checked.

2.3.33.11 Limitation, Durability: The motor circuit breakers will be current limiting for a mains voltage of 400 V, the maximum let-through energy (I2t) on short-circuit being extremely low. The motor circuit breakers will have a high electrical and mechanism durability of at least 5 times that required by the standard.

2.3.33.12 Protection functions:

General recommendations:

a) The motor circuit breakers will be equipped with releases comprising a thermal element assuring overload protection and a magnetic element for short-circuit protection.
b) In order to ensure safety and avoid unwanted tripping, the magnetic trip
c) threshold (fixed) will be factory set to an average value of 12 Ir.
d) All the elements of the motor circuit breakers will be designated to enable operation at an ambient temperature between -20°C and + 60°C without derating.
e) The thermal trips will be adjustable on the front by a rotary selector.
f) The adjustment of the protection will be simultaneous for all poles.

2.3.34 Isolators

2.3.34.1 Isolators shall be fixed on wall, on self-supported galvanized angle iron frame work as required and mounted as near to the motor as possible. Where several motors are installed, isolators if required shall be provided at a central location on a common frame work with prior approval at site. The Isolator shall be provided in IP 65 enclosures from the Isolator manufacturer only.

2.3.34.2 Painting, earthing and labels shall be provided as generally indicating for MV Switchgear and as shown on drawings.

2.3.35 Surge Protective Devices (SPD)

The work required under this section shall include all material, labour and auxiliaries required to furnish and install complete Surge Protection Devices at main LT Panel incoming feeders Class 1 (Spark Gap) & Sub Distribution Boards Type 1+2 and the DB level Type 2+3 for the protection of Building electrical and Electronics system from the effect of Lightning discharges, line induced transient surge voltage or switching surges

2.3.35.1 Main Electrical panels (Transformer and DG Incomer's)

According to IEC 61643-11 and EN 61643-11, in order to avoid oscillations and magnetic coupling phenomena, equipment must be protected against direct surges with din rail Type 1 (10/350µs) surge arresters. Surge protection with integrated arrester backup MCB/Fuse.

Surge Protector at Type 1 L T Panel Protection)

The Surge Protection Device (SPD) manufacturer shall offer a complete line of Surge Protection Devices to support the requirements for Main LT Panel Incoming feeders. The surge protector at this stage shall be provided to protect the downstream electrical and electronics against any lightning discharges surges that may enter into the system through Mains panel.

The Protection unit shall be based on single arc spark gap technology and shall be able to withstand 10/350 microsecond surge currents associated with external lightning discharges

Type-1 SPD for Entry point after Transformer (Stage-1) Main LT Panels

SL No.	Characteristics	Parameter
1	IEC test Classification	Type-1 / Class-1
2	Technology	Metal Encapsulated Spark Gap Technology
3	Certification	KEMA KEUR / VDE / NABL tested as per IEC 61643-11 / UL
4	Pluggability	Pluggable for Safe and Easy Maintenance
5	Nominal Voltage Un	240 V AC (TN-S) / as per NBC-2016
6	Max. Continuous operating Voltage Uc (L-N / N-PE)	1.1*240 V AC/as per NBC-2016
7	Impulse Discharge Current Iimp (10 / 350µs) (L-N)	25 kA
8	Impulse Discharge Current Iimp (10 / 350µs) (N-PE)	100 kA
9	Short Circuit Current rating I_{SCCR}	50 kA for L-N & 100A for N-E
10	Voltage Protection Level Up (L-N)	≤ 1.5 kV
11	Temporary Over Voltage behavior at U_T (L-N)	440 V / 120 min-withstand mode
12	Temporary Over Voltage behavior at U_T (N-PE)	1200V AC (200ms / withstand mode)
13	Max. length from SPD to Earth bus bar in panel	0.5 meter
14	Response time t_A	≤100 ns

2.3.35.2 Sub Electrical Switchboards Protection with type 1+2 Surge Protective Devices

According to IEC 61643-11:2012 and EN 61 643-11:2012 electrical installations must be protected against direct lightning and surge impulses with din rail Class. Surge protection with integrated arrester backup MCB/Fuse.

I+II/Type 1+2 (10/350µs) surge arresters.

SPDs use MOV technology to allow for high lightning discharge currents, pluggable types avoid ejection of the cartridge during the discharge of the current and non-blow out technology avoids fire risks.

The SPD must provide either common protection in TNC network or common and differential mode protection in TT and TNS networks according to IEC 61643-11:2012 recommendations.

Supply, install and connect Surge Protective Devices with the following technical characteristics:

Type-2 SPD for Sub-Distribution Panel (Stage-2)		
SL No.	**Characteristics**	**Parameter**
1	IEC test Classification	II / T2
2	Technology	L-N: MOV Technology & N-PE: GDT Technology
3	Certification	KEMA KEUR / VDE / NABL tested as per IEC 61643-11 / UL
4	Pluggability	Pluggable for Safe and Easy Maintenance
5	Nominal Voltage Un	240 V AC (TN-S)
6	Nominal Discharge Current In (8 / 20µs) (L-N & N-E)	10 KA(L-N) & 20KA(N-E)
7	Maximum Discharge Current Imax (8 / 20µs) (L-N & N-E)	20 KA(L-N) & 40KA(N-E)
8	Short Circuit Current rating I_{SCCR}	25 KA(rms) (L-N) & 100Arms (N-E)
9	Voltage Protection Level Up (L-N)	≤ 1 kV
10	Temporary Over Voltage UT (L-N)	275 V AC (5s / Withstand Mode) 440V (120min safe failure mode)
11	Temporary Over Voltage UT (N-PE)	1200 V AC (200ms / Withstand Mode)
12	Max. length from SPD to Earth bus bar in panel	0.5 meter
13	Response time[L-N],[N-PE] t_A	≤25 Ns, ≤100 Ns

2.3.36 Remote Monitoring

The following critical status and alarms for each LVSB shall be sent to SCADA for remote monitoring via volt-free contacts or serial interface over standard protocol communication as approved:

a) Individual ACB/MCCB open/close status,
b) Common alarm for ACBs/MCCBs trip on fault/lockout,
c) Type of fault along with magnitude of fault and time stampings.
d) Common alarm for any local/remote or local/auto selector switch in local mode,
e) Control supply failure,
f) ACB ready to close indication.
g) Emergency push button (EPB) operated, and
h) Voltage, current, frequency and energy parameters. of all the phases and total with number of operations.
i) LVSB under voltage alarm and cause of tripping.
j) MCCB must store last 20 trip history along with 100 events log.

2.3.37 Current Transformers (CTs) and Voltage Transformers (VTs)

2.3.37.1 CTs and VTs shall comply with BS 3938/ BS 60044, IEC 60185 or IEC 60044 and CTs shall be of the epoxy resin encapsulated ring type. The ratings specified on the Drawings are indicative only and it shall be contractor / manufacturer's responsibility to ensure that the ratings offered are adequate for the relays / meters provided considering lead resistance, etc.

2.3.37.2 All CTs shall have a short-time current rating of not less than 65 kA for 3 seconds on primary side.

2.3.37.3 Multi-ratio CTs (where used) shall have a label clearly indicating the connections required for the alternative ratios. These connections shall be shown on panel wiring diagrams.

2.3.37.4 Identification labels shall be fitted, giving type, ratio, rating, output and serial numbers. Duplicate rating labels shall be fitted on the exterior of the mounting chambers suitably located to enable reading without the removal of any cover or metal sheeting forming part of the structure of the LVSBs.

2.3.37.5 CTs for protection shall be compatible with the protection relays to ensure that the CTs will not be saturated up to the maximum prospective fault current.

2.3.37.6 CTs designed for unit protection schemes shall be able to with stand stability of not less than the maximum through-fault of the units.

2.3.37.7 In balanced circuits, the spill current with maximum stability conditions shall not exceed one quarter of the operating current of the relay.

2.3.37.8 CTs for use in conjunction with protection relays shall be of class 5P accuracy or better. CTs for use in conjunction with measuring instruments shall be of Class 1 accuracy. The product of rated accuracy limit factor and rated output of the protection CTs shall not be less than 20 times the total rated burden of the trip circuit including the relay, connection leads and O/C release where applicable.

2.3.37.9 All CTs shall have output ratings adequate to cater for the burden connected to them. The Contractor shall demonstrate to the satisfaction of the Employers Representative, by calculation or by test, that each group of the CTs, when installed and having the secondary burden connected, is capable of operating the relays and other measuring instruments in accordance with the manufacturer's published characteristics and the requirements of the system, with a reasonable margin of safety.

2.3.37.10 Measuring CTs shall be connected to test terminal block. The test blocks shall be provided with easily removable links and designed to facilitate connection of testing instruments on load without open-circuiting the CT's.

2.3.37.11 The secondary circuit of each set of CTs shall be earthed at one point only through a disconnect able copper link at a readily accessible position for testing.

2.3.37.12 VTs shall be provided with adequately rated primary and secondary fuses.

2.3.38 SCADA / RJ45/ MODBUS connectivity of communicable ACB / MCCB

2.3.38.1 Junction box suitable for four no ACB connection shall be provided asper requirement.

2.3.38.2 Connecting cable with connector between ACB communication unit and junction box shall be provided.

2.3.38.3 24V DC source unit or as required (Incoming supply shall be taped form the control supply available in the panel) for communication of ACB/MCCB with SCADA system.

2.3.39 Contactors

2.3.39.1 Contactors shall comply with IEC 60947-4-1 or EN60947-4-1.

2.3.39.2 Contactors shall be electro-magnetically controlled, double air-break type. Contactors shall be four-pole, triple-pole, double-pole or single-pole as shown on the Drawings.

2.3.39.3 The mechanical endurance of the contactors shall not be less than 3million no-load operating cycles.

2.3.39.4 Contactors shall be silver or silver-faced.

2.3.39.5 The contactor should be modular in design with minimum inventory requirements and built – in mechanically interlocked. They should be suitable for the addition of auxiliary contacts and other electrical auxiliaries without any compromise on the performance or the operation of the contactors. The contactors from 4KW to 400kW shall be associated with the same auxiliary contact block range.

2.3.39.6 The control contactors for power factor correction equipment shall be of quick break and have a high arc resistance during switching operation. Contactors shall be of utilization category AC–6b for this application and specifically designed for switching directly connected capacitor banks.

2.3.39.7 The contactors for other applications shall have an un-interrupted rated duty and utilization category of at least AC3 at 415V and 50 Hz. The contacts should be of fast opening and fast closing type.

2.3.39.8 The making and breaking capacity values of the contactors should be as follows (as per IEC 947-4)

a) For AC3duty:
   - Making capacity equal to or more than 10Ie
   - Braking Capacity equal to or more than 8Ie

b) For AC4duty:
   - Making capacity equal to or more than 12Ie
   - Braking Capacity equal to or more than 10Ie

2.3.39.9 The contactors should be capable of frequent switching and should operate without derating at 60^{o}C for AC3 applications. They should be climate proof. The coil of the contactor should have Class-H insulation to support frequent switching.

2.3.39.10 The rated voltage of the contactor and the rated insulation voltage shall be 690V. The rated impulse voltage of the contactor should be at least 8KV.

2.3.39.11 Wherever DC control is required, the contactor should have wide range (0.7to 1.25 Uc) DC coil with built in interference suppression as required.

2.3.39.12 The control and power terminals should be at separate layers preferably with colour coding (black for power and white for control). All contactors power connection shall be finger safe (IP 2X).

2.3.39.13 They should be capable of being integrated into automated system (PLC's) without any interposing components in the minimum operating conditions.

2.3.40 Finishes

2.3.40.1 All exposed metal surfaces, both internal and external, shall be thoroughly cleaned of all dust, oil, grease, dirt, scale, rust or other contaminant sand shall be epoxy powder coated immediately at the manufacturer's factory.

2.3.40.2 The epoxy powder coating shall be not less than 75 microns thick and with colour in accordance with BS 381C or BS 4800 as approved by Engineer.

2.3.40.3 All surfaces of the LVSBs shall have any damage to the finished coating made good on completion of installation and shall then be painted to its original finished colour.

2.3.40.4 Painting procedure, paint samples and manufacturers shall be approved prior to commencement of painting.

2.3.40.5 Touch-up proposals to make good any areas/surfaces that have been damaged on site or in transit shall be as approved.

2.3.41 Nameplates and Label's

2.3.41.1 Nameplates

2.3.41.2 Each LVSB shall have permanently attached to it in a conspicuous position a label or labels upon which shall be engraved or stamped with the manufacturer's name, type and serial number, date of manufacture, designation of each LVSB, details of the loading and duty at which the item of the LVSB has been designed to operate. Such labels shall be of non-hygroscopic material.

2.3.42 Labels

(a) Labels shallbe provided for every panel to describe the duty of or otherwise identify every instrument, relay or item of control equipment mounted externally and internally.

(b) The designation on these labels shall be clear and shall, where applicable, incorporate the device number along with concise descriptive wording in English.

(c) Externally fitted panel labels shall be of Perspex or other approved transparent plastic with letters and numbers rear engraved and filled with black.

(d) Internally fitted panel labels shall be finished in white with engraved letters and numbers filled with black, laminated material such as Traffolyteorrear engraved and filled plastic may be used. Embossed materials and techniques will not be accepted.

(e) Labels shall be provided in conformity with the above requirements or by other approved means wherever necessary to designate panels or panel sections, to describe or identify circuits or circuit components, to provide warnings or reminders of dangerous or potentially dangerous circumstances and wherever called for elsewhere in this M&W Specification.

(f) Safety labels "Danger, 415 V" in both English and Hindi shall be provided on both the front and rear of the LVSB's. The safety labels shall have graphic symbols and wording in red on a white background. The design of all such signs shall be submitted for approval. Similar labels shall be provided for other panels at different voltages.

(g) Labels shall not be less than 45 mm high. Lettering shall be of not less than 10 mm high. All labels shall be securely fixed to the panels by bolts and nuts.

(h) Details of proposed inscription, including the English and Hindi wordings, and samples of the labels shall be submitted for approval before any labels are manufactured.

2.3.43 Installation

2.3.43.1 The LVSBs shall be installed in the locations as approved by the Engineer. LVSBs shall be secured, plumbed and levelled and in true alignment with related adjoining work.

2.3.43.2 The rigid galvanized U-channels with adjustable levelling screws to ensure effective fixing of the LVSBs on the uneven floor shall be provided.

2.3.43.3 Anchor bolts and anchorage items shall be provided where required and field checked to ensure proper alignment and location. Templates, layout drawings, and supervision on Site shall be provided to ensure correct placing of anchorage items in concrete.

2.3.43.4 Supporting members, fastenings, framing hangers, bracing, brackets, straps, bolts, angles, shall be installed as required to set and rigidly connect the work.

2.3.43.5 Temporary bracing, guys, or other devices shall be provided as required to accomplish erection and to provide safety and stability until the LVSB is in its final and approved position.

2.3.43.6 Erection tolerance requirements shall be controlled so as not to impair the strength, safety, serviceability, or appearance as Approved.

2.3.43.7 After installations are complete, all places where the shop applied coating is abraided, all bare steel, including bolts, nuts, washers, and welds shall be thoroughly cleaned. Each item shall be painted with the same paint as used for shop coating in the corresponding location.

2.3.44 Relay & Current Transformer (CT) Requirements for Transformer Standby Earth Fault & LV Restricted Earth Fault Protections

2.3.44.1 The LV Standby Earth Fault Relay (64) shall have adjustable characteristics including SIDMT, VIDMT, EIDMT and DTL characteristics and in each instance having separately adjustable time and current settings. The current against time characteristics for IDMT characteristics shall be to EN 60255 or IEC 60255.The relay shall match with the LV neutral CT provided by Power Supply System Contractor and be rated at 1A.

2.3.44.2 The LV Restricted Earth Fault Relay (87 G/T) shall be of voltage operated high impedance type and shall operate instantaneously without time delay. The voltage settings shall be ranged from 25 V to 175 V. Metrosil shall be provided in order to protect the relay from being damaged by overvoltage during fault conditions. Stabilizing resistor shall also be provided to ensure the relay will remain stable under maximum through fault conditions.

2.3.44.3 The current transformers for LV restricted earth fault protection on line and neutral sides shall be of Class X and ring type. The specifications shall be as follows:

(a) Knee Point Voltage: Vk> 250 V; Remark: The knee point voltage of the CT's shall be greater than two times of the Approved relay setting.

(b) Resistance at 75 °C < 4.5ohms

(c) Imag at 125V<30mA The line side and neutral CT's shall match with each other. The magnitudes of the spill currents shall not cause instability of the LV REF protection under through fault conditions. The Contractor shall co- ordinate with the Power Supply System Contractor for the exact requirements.

2.3.44.4 The size of CT wirings shall not be less than 6 mm². The conductors shall be of standard, high conductivity annealed copper wires in compliance with Table II, Class 2 of IEC 60228.

Terminals and cable lugs for connecting the secondary wiring of CT's shall be of stud and ring types respectively. When the CT's and protection relays are fitted, facilities shall be provided for primary and secondary injection tests to be carried out. These facilities shall be such that wires and connections need not be disconnected for the tests to be carried out and the need for de-energization of the equipment is not required.

2.3.45 Other Provisions

2.3.45.1 The LVSB shall be provided with all necessary cable lugs etc., fixed in positions on mounting plates and straps, to suit the types and directions of entry of the cables as shown on the Drawings or as specified.

2.3.45.2 Cable conductors for all circuits within the LVSB shall be arranged in a tidy manner and mechanically secured at regular intervals such that any movement occurring to the conductors, either under normal operation conditions (e.g. thermal expansion, vibration, etc.) or due to short circuit in any one of the circuits, shall not cause any damage or short circuit to any healthy bare live parts in the LVSB.

2.3.45.3 Each LVSB shall be supplied complete with all operating handles jigs, etc. required for the normal charging, closing, opening, racking in and out operations of all circuit breakers of the LVSB and shall be properly fixed in a neat manner on a board with brass hooks inside the switch room/plant room where the LVSB is installed.

2.3.45.4 Each LVSB shall be provided with two rubber mats of ribbed surface, complying to BS 921 or equivalent Indian standards, laid in front of and at the rear of the switchboard. The rubber mats shall be continuous sheets of minimum thickness of 10 mm, each of same length as the switchboard and minimum width of not less than 1000 mm or the width of the space between the front or back of the switchboard to the adjacent wall.

2.3.45.5 Hydraulic operated handling truck suitable for handling all sizes of air circuit breakers for the LVSB shall be provided as required.

2.3.46 Annunciation

2.3.46.1 The alarm annunciation scheme shall include facia units with a relay for each fault, a common alarm bell and Accept / Reset / Test pushbuttons.

2.3.46.2 The alarm annunciation scheme shall operate as follows:

Table 1.1 Alarm Annunciation Scheme

Condition	Visual	Audible
Normal	Off	Off
On occurrence of fault	Flashing	On
Acknowledge fault	Steady	Off
Reset, fault cleared	Off	Off
Reset, fault not cleared	Steady	Off
Lamp test	Steady	Off
Alarm annunciation test	Flashing	On

a) It shall also be able to switch the load back to the normal supply under manual control.

3.0 EARTHING

3.1 General

3.1.1 This section specifies the manufacture, supply, Installation, testing & commissioning of Earthing system for the Underground Metro Stations. It covers the Earthing System requirements for AC power system except Traction power system.

3.2 Standards

3.2.1 **Relevant Codes and Standards**

STANDARDS	DESCRIPTION
BS 7430	Code of Practice for Earthing.
BS 7671	Requirements for Electrical Installations
ANSI/IEEE Std 80-2000	IEEE Guide for Safety in AC Substation Grounding
IEC 60364	Electrical Installations of Buildings
IEEE 1100	Recommended Practice for Powering and Grounding of Sensitive Electronic equipment
IEC 62305 -1 to 4 :2020	Protection against lightning
IEC 62561 :2017	Lightning protection system components
BS 2874 /IS:3043-1987	Specification for copper and copper alloy rods and sections (other than forging stock)
BS 729	Specification for hot dip galvanized coatings on iron and steel articles

3.3 Technical and Installation Requirements - Earthing and Bonding

3.3.1 **General Requirements**

3.3.2 All metal works associated with an electrical installation but not forming part of live conductors, including exposed conductive parts and extraneous conductive parts, shall be solidly and effectively bonded and earthed.

3.3.3 The design of the systems shall facilitate the rapid detection and disconnection of earth faults. Isolation of the faulty system shall be fast enough to protect human beings and to limit damage to plant and equipment.

3.3.4 The earthing systems shall be capable of carrying full fault currents.

3.3.5 The design of the system shall minimize the occurrence of electrical interference, particularly between power cables and communications systems.

3.3.6 The maximum voltage between a live conductor under fault conditions and the general mass of earth shall be no greater than 50 V and the main earth shall have a maximum resistance to earth of 1.0ohm.

3.3.7 The materials for the earth systems shall be such as to avoid electrolytic corrosion and ensure a life of 100 Years. Earth rod electrodes and earth conductors shall be 99.9% conductivity copper.

3.3.8 The earthing system shall be in compliance with the Section 61 of Indian Electricity Act and Section 4 of IS 3043:1987 with latest amendments, if any.

1. To provide safety for the operating & maintenance personnel against electric shock on account of any potential(voltage)appearing on exposed equipment or conductive surfaces with respect to earth due to electromagnetic or electrostatic induction.

2. To ensure safe & reliable operation of the equipment by limiting or eliminating the induced voltages in the Signaling & Train Control and Telecommunication equipment's arising from within BMRCL on account of traction voltages, traction return current, rolling stock characteristics and other extraneous sources in the vicinity of SYS01 installations.
3. To protect equipment against buildup of unduly high voltages, which can cause dielectric (Insulation) breakdown or damage to the equipment or their parts.
4. To serve as a common voltage reference point.
5. Any electrical joints in the earthing system shall be protected from moisture ingress by using proper wrapping, sealing with water proof tape, or such other approved measures.
6. For the purpose of measurement of earth resistance, a small interconnecting copper strip of appropriate cross-section shall be provided in the ring earthing a small accessible chamber so that the ring earth can be broken from the loop for testing.
7. Reduction in potential to system neutrals.

3.4 Main Earthing Terminal

3.4.1 Earth GI strip shall comply the BS 2874 /IS:3043-1987.

3.4.2 The Contractor shall provide an earth bar, in each of the substations, of ample size near the main incoming switch or switchboard for the connection of the circuit protective conductors, the main equipotential bonding conductors and the earthing conductors to create the equipotential zone and to meet the requirements of Other / System wide Contractors. The Contractor shall use this earth as the "LV main Earthing Point / Terminal". The main earthing terminal complete with a disconnecting link of 75 x 10 mm GI bar shall be connected to the earth via an earthing conductor to Principal Earth Terminals. Additionally, the Contractor shall provide separate clean earth as required. The Contractor shall liase and co-ordinate closely with System wide Contractors to select the most suitable locations around the station and other tunnel structures to locate earth electrodes.

3.4.3 For each test electrode, one principal earth conductor above the finished floor screed will be provided by the Contractor. Bolted bimetallic links similar to those described in Clause above shall be provided at the top of the principal conductor above the finished floor screed. The link shall be labelled "Test Electrode Connection".

3.4.4 The physical arrangement of the links and their connections shall be such as to protect them against possible mechanical damage

3.4.5 The tee-off main conductors of the main earth network shall be routed close to all plant rooms provided with main earth terminals at each level of the building. The tee-off main conductors shall be connected to the two vertical rising main conductors at each level of the building to form a closed ring network. Sub tee-off earth conductors shall be connected from the tee-off main conductors to the earth terminals provided in the plant rooms. The sub tee-off earth conductors and earth terminals of sizes as shown on the Drawings shall be provided by the Contractor. The sub tee-off earth conductors and earth terminals shall be hard drawn GI tapes.

3.4.6 Earth GI strip should be hot galvanized as per BS729.

3.5 Main Equi-potential Bonding Conductor

3.5.1 Unless otherwise specified, main equipotential bonding conductors shall be of copper. Aluminum or copper clad aluminum conductors shall not be used for bonding connections.

3.5.2 Bonding wires shall be not less than 2.5 mm^2 in cross section and the insulation shall be coloured green/yellow.

3.5.3 Main equipotential bonding conductors shall connect the extraneous conductive parts of other services within the premises to the main earthing terminal of the installation. Such extraneous conductive parts shall include main water and gas pipes, other service pipes and risers and exposed Cable Trays, walk way structure parts of the building structure liable to transmit a potential. Connections shall be made as near as practicable to the point of entry of the non-electrical services into the premises concerned, and shall be on the installation side of the possible breaks in the system, such as gas meter or water meter.

3.5.4 Each item of equipment shall be fitted with an earthing stud to which the framework of the cubicle shall be bonded. When cubicles form composite equipment such as a switchboard these studs shall be connected by an earthing bar.

3.5.5 Bonding conductors shall be rated to carry the prospective fault currents for3 second and to limit potential differences under fault conditions to safe levels taking into account the expected duration of any fault.

3.5.6 The main equipotential bonding conductors shall be securely and reliably connected to extraneous conductive parts of the non-electrical services by means of a copper connector-clamp of an approved type suitable for the particular applications. All contact surfaces shall be clean and free from non- conducting materials, such as grease or paint, before the connector-clamp is installed.

3.5.7 Running joints shall be either welded or brazed such that the resistance of a short section containing the joint shall be not greater than that of a similar length of unjointed conductor. The Engineer may require any joint to be tested to prove compliance with this requirement. All joints shall be applied with protective paint finish to prevent oxidation.

3.5.8 No drilling of the earth bar shall be permitted except in termination. Joints and connections to the earth system shall be so affected as to avoid undue reduction of the current carrying capacity. Precautions shall be taken to ensure that available contact area is fully utilized in all connections to plant and equipment. The contact faces of earth terminals shall be cleaned before connections are made to the earth system. The bar shall be tinned before being clamped to the earth stud. Joints to the switchboards and sub-switchboards may be by bolts and the area of contact shall be large and the joints shall be tight.

3.5.9 Earth conductors shall be flat copper strip of high conductivity. Fixing to buildings shall be by means of copper or brass clamps with brass screws and non-fibrous wall plugs. Conductors fixed in visible locations shall be run only in vertical and horizontal directions. Changes of direction in the plan of the conductors shall be by right-angled joints. Folding of the conductor shall not be permitted

3.5.10 Particular care shall be taken on cable termination boxes to ensure that the cable sheath and Armour is adequately bonded to the frame of the item of plant to which the

cable is connected. If the earth continuity through the cable termination gland is inadequate then a special copper connection shall be made between the equipment and the cable sheath anadromous.

3.5.11 Conductors shall be bare or sheathed cables as specified or as directed by Engineer for both main and clean earth.

3.5.12 The earthing conductor shall be connected to the earth electrode(s) by means of approved copper connector-clamps such that the connection can only be disconnected by means of a tool. The connection shall be contained within a concrete lined earth pit with a substantial removable cover to ensure accessibility and maintainability.

3.6 Protective Conductors for Electrical Apparatus

3.6.1 All metal parts including pipe work and cable trays, other than those forming parts of any electrical circuit, shall be effectively connected in an approved manner onto the earth system.

3.6.2 All switch/distribution boards shall be earthed using earth strip to the main earth network, which shall also be used by other Contractors for earthing their equipment as generally shown on the earthing arrangement drawing. All necessary earth strips to join to the main network shall be included during preparation of Working Drawings.

3.6.3 All doors shall be bonded to the cubicle framework by means of multi-stranded flexible wire. Such connections shall not obstruct the movement of doors or be stressed by the operation of the door.

3.6.4 All withdrawable devices such as circuit breakers and relays shall have provision for positive earthing of the frame of the device before any plug in a main or auxiliary electrical circuit connects to the device. The clearances must be maintained between fixed conductors and conductors on the withdrawable device until the earthing connection is made.

3.6.5 At each switchboard position a minimum 400 mm^2 cross sectional area squared tape shall be fitted to bond together the armouring of cables, cases of switchgear and frame of switchboard.

3.6.6 All tape joints shall be sweated and bolted with GI bolts, nut and washers. Where the earth tape is bonded to any item of equipment, the tape shall be tinned and clamped (with brass bolts, nuts and washers) to bright metal smeared with a proprietary jointing compound.

3.6.7 Joints shall be made so as to ensure a low resistance to earth.

3.6.8 Where moulded case circuit breakers are protecting sub-main armoured cables and regulation 543 of the 16th Edition IEE Regulations is not fulfilled, an additional single core earth conductor sized in accordance with table 54G shall be incorporated to form the return path.

3.6.9 All sub-main and final sub-circuits utilizing single core cables shall incorporate separate earth protective conductors hence conduit / trunking shall not solely form the earth return. Earth protective conductors shall be sized in accordance with table 54G of the 16th Edition IEE Regulations.

3.6.10 Low voltage switchboards and MCCs shall be connected to the earth system by two conductors of not less than 400 mm2 cross-sectional area at both ends of the switchboards and MCCs.

3.6.11 Earth connections for all items of equipment shall be made between the equipment and the distribution board feeding it.

3.6.12 Where conductors could come into contact with metalwork at or near-earth potential, they shall either be bonded solidly or shall be insulated to withstand an alternating potential difference of 500 VR.M.S.

3.6.13 All equipment, plant or pipe work, to be earthed shall be connected to the main earth conductor by subsidiary GI conductors in accordance with the following table:-

Table 9.1 Earthing Conductor

Apparatus	Conductor	
	No. Of Conductors Minimum	Size (mm 2) (As per fault Level)
415 V motor casing (5-15 kW)	2	-
415 V motor casing (over 15 kW)	2	-
Control panel (Single)	2	-
Distribution boards and other Equipment or plant (over 15 kW)	2	-
Distribution boards and other Equipment or plant (15 kW or less)	2	-

3.6.14 All connections between earth conductors and equipment or plant shall be by bolts or studs so arranged that the resistance between the equipment or plant and the earth conductor should not exceed 0.1ohms.

3.6.15 No earth stud or bolt shall have a cross-sectional area at the base of the threads less than15mm2.

3.7 Earth Pits and Earth Electrodes

3.7.1 The earthing system within each station shall be connected to the earth mats via the Main earth bar. There shall be liaison with other Contractors to determine the best place to locate earth electrodes/pits.

3.7.2 The earthing electrodes for equipment enclosures, electrical neutrals shall be separate and distinctly located within the station area from the lightning protection. The corresponding earthing bus bars shall be visually distinct and separately identifiable. Earth bus bars shall be located so as to permit access for testing, maintenance and replacement.

3.8 Earthing Cable Colour Identification

3.8.1 All cables used as protective conductors, including earthing conductors, main equipotential bonding conductors, supplementary bonding conductors and circuit protective conductors shall be identified by the colour combination "green and yellow". Such colour combination shall not be used for other identification purposes.

3.8.2 Labels for Earthing and Bonding

3.8.3 Equipotential bonding conductors shall be labelled “NOT CONNECTED TO EARTH” where electrical separation has taken place.

3.8.4 Labels shall be fitted at the point of bonding. All bonding cables connected to the main earth terminal bar shall be identified within the earth terminal enclosure.

3.8.5 Metal labels shall be fixed to all types of bonding conductor stating “Safety Electrical Connection – Do Not Remove”.

3.9 Testing

3.9.1 The Contractor shall be responsible for providing all necessary test equipment and consumables to complete the required tests satisfactorily. He shall at his own cost rectify and retest any installation which fails its test. Load testing or any other functional test that the Employer may require is to be conducted at no extra cost.

3.10 Tests shall be carried out as follows:

3.10.1 The resistance to earth of each electrode,

3.10.2 The quality of metal joints (conductor tests),

3.10.3 Each earth termination network shall have a measured resistance no greater than its design value,

3.10.4 Additional earth pits or conductors shall be provided, if necessary, to achieve the required value of resistance.

3.10.5 Earth fault loop impedance tests shall also be carried out at regular intervals and results maintained.

3.10.6 Testing of earthing system shall be carried out on completion and regularly thereafter and results recorded in order that any trend towards increasing resistance can be noted and necessary action can be planned.

3.10.7 The tests shall be carried out with the test link (s) located at the earth lead termination points removed, but only for so long as it takes to carry out the test. The earth mats at each location shall be tested separately and at least one earth mat shall always be connected to the earthing system during tests.

3.10.8 On completion of the earthing installation the earth fault loop impedance shall be tested in accordance with BS 7671. The results shall be presented for Approval.

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